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日本植物病理學會報

第二卷 第一號

稻胡麻葉枯病菌培養中子囊時代形成

伊藤誠哉
栗林數衛

PRODUCTION OF THE ASCIGEROUS STAGE IN CULTURE OF *HELMINTHOSPORIUM ORYZAE*.

By

Seiya ITO and Kazue KURIBAYASHI.

(With Plate I—III)

Small blackish sclerotia-like bodies which may be considered as an initial stage of perithecia are sometimes found in the culture of *Helminthosporium Oryzae*, the causal fungus of the leafspot disease of rice-plant. In 1922, NISHIKADO and MIYAKE[1] recorded and figured such a body of this fungus found in the culture on steamed maize-leaves. However, the fully grown perithecium of this fungus has not been recorded up to the present time and we explained provisionally that the absence of the ascigerous stage in the life-cycle of this fungus probably has a relation to the longevity of its conidia, as has been stated by DRECHSLER.[2]

In the autumn of 1925, grains of rice were collected from various places in Hokkaido for the study on the "rusted rice" (*Sabimai* in Japanese), that is, rice-seeds with a brownish discolored or spotted surface. In the course of the

1) Studies on the Helminthosporiose of the Rice-plant. (Ber. Ohara Inst. Landw. Forsch. II, Heft 2, p. 133–195, 9 pls., 1922).

2) Some Graminicolous Species of Helminthosporium: I. (Jour. Agr. Res. XXIV, no. 8, p. 641–749, 33 pls., 1923).

study, *Helminthosporium Oryzae* was very often isolated from such a seed. Among them, a strain of this fungus designated as No. 2, which was isolated from the variety "Bozu" of rice-plant collected at Sapporo-mura, produced numerous sclerotia-like bodies as in other cases, but they were little larger than those hitherto observed and suggested the possibility of being the perfect stage of this fungus. This led to a careful examination of cultures to find out the ascigerous stage of the fungus in question.

As far as we are aware, the mature perithecia are formed in the cultures of the conidia and hyphae isolated from the grains, pericarps and seeds of rice, especially from the last, while they are formed not at all or in a slight degree, as well as in an imperfect state in those from the affected leaves of the same plant. The results of this experiment on strain 2 are given in Table I.

Table I.

Showing the different degree of the formation of perithecia in the cultures isolated from various parts of the affected rice-plant.

(*Cultures were all on rice-culm decoction agar and were kept in 25° thermostat*).

Part of the plant from which spores were isolated	Number of cultures		
	Total	Conidia produced	Perithecia produced
Seed	45	43	28
Grain	45	45	28
Pericarp	30	30	24
Rachis	45	32	18
Leaf	45	45	2

Though we are not able to explain the phenomenon clearly, but for the present it will be sufficient simply to state the fact, that the mature perithecia have not yet been found in our cultures, when we used the spores isolated from the affected leaves for inoculation. Even on a filter paper in Petri-dish, on the other hand, the mature perithecia were produced in the case of seed, while not in others (sheath and leaf-blade).

The perithecia are formed in the cultures of almost all strains examined, which were isolated from seeds, with a different degree as shown in the following table :—

Table II.

Showing the different degree of the formation of perithecia in various strains examined.

(*These cultures on rice-culm decoction agar were all kept in 25° thermostat*).

Strain	Variety of rice	Locality	Number of cultures		
			Total	Conidia produced	Perithecia formed
1	Bozu no. 5	Sapporo	85	2	1
2	Bozu	Sapporo-mura	50	46	34
3	Date-chikanari	Hayakita	58	2	1
4	Akage	"	52	0	0
5	Bozu	Bibai	60	15	2
6	Hashiri-bozu	"	50	28	7
7	Akage	"	54	11	3
8	Bozu	Teshio	50	32	19
9	Chinko-bozu	"	50	15	9
10	Tokachi-kuroke	"	54	22	9
11	Bozu	Setana	50	3	1
12	Chusei-shiroke	"	50	2	2
13	Bozu	Oshima	10	3	1
14	Bozu no. 5	"	14	3	1
15	Chusei-shiroke	"	10	2	1

For the formation of perithecia, rice-culm decoction agar is the most suitable medium and optimum temperature seems to be about 25° C. The single-spore-cultures from the typical conidium of *Helminthosporium Oryzae* were often tried and succeeded to produce the perithecia.

On the fourth or fifth day of culture, the minute whitish masses among web-like mycelium will be detected by the naked eye on the surface of cultural media. Later on they are also formed on the wall of cultural vessels. These bodies increase in size and number, as well as become grayish in color with a central black spot. They appear blackish when viewed from underside of cultural vessels (Pl. II, fig. 3). Among them, some cease to grow and remain as sclerotia-like bodies, while others develop to perithecia. The perithecia attain their full size in about fifteen to twenty days, and the asci are mostly mature in twenty five to thirty five days.

The lower portion of the mature perithecium is mostly immerced into cultural medium, having many brownish hyphae around it. The external wall

of the perithecium is pseudoparenchymatous and dark yellowish brown in color. The body is globose or depressed globose, with a well defined, paraboroid and smooth ostiole (Pl. I, fig. 1). The interior is composed of colorless pseudoparenchym in its younger stage. The asci are numerous in a perithecium. The young asci are mostly irregularly curved and filled with granular, vacuolated and hyaline contents. The mature ones are cylindrical or long fusiform in shape, with the widest portion at about two third of their length from the apex, mostly slightly curved and provided with a short straight or curved stipe. The apex is rounded, not thickened, but sometimes thickened in younger stage. The wall is thin and hyaline. Each ascus contains one to eight, mostly four or six ascospores, which are filamentous or long cylindrical in shape, with the widest portion at about one third of their length from the apex, attenuating toward the both ends. The apex is obtusely rounded and the base is pointed, so that we can easily distinguish them from each other. In maturity, six to fifteen, mostly nine to twelve, septa are formed. The ascospores coil in a close helix in regular sinuous course in the ascus and seem to be light olive color in a low magnification. The degree of coiling is more loose in the young stage as well as in the few spored asci (Pl. I, fig. 2). When the mature asci are pressed slightly under a cover glass, the ascospores are discharged forcibly from the apex and the coils are reflaxed in loose curves. The liberated ascospores are suited for the examination of their morphological characters in detail. They are often provided with a mucous envelope and the constrictions at the septa become more conspicuous in such a free state (Pl. I, fig. 3a & 3b).

The measurements of each part of the ascigerous stage are given in the following table :—

Table III.

Parts of perithecia	On rice-culm decoction agar	On filter paper
Body	463–572=368–504μ	627–763=518–777μ
Ostiolar beak	95–123= 55– 68μ	109–190= 82– 95μ
Ascus	142–235= 21– 32μ	164–225= 25– 36μ
Ascospore	250–468= 6– 9μ	293–421= 6– 7μ

The liberated ascospores began to germinate in about thirty minutes, producing three to six germ-tubes in water or ten to fifteen germ-tubes on rice-

culm decoction agar (Pl. I, fig. 3c). The hyphae grow fairly well on the culture, and the mycelial mass attains 25 mm. in diameter in four days culture of the latter. The conidia were produced in the culture after ten days and were proved to be the typical ones of *Helminthosporium Oryzae* under the microscope. The conidia thus obtained were inoculated to rice-foliage, on which a characteristic lesion appeared as the result of infection (Pl. II, fig. 3a).

In 1909 and 1910, I. MIYAKE[1] published two papers on the parasitic fungi of rice-plant in Japan, with an enumeration of all the species recorded on the same plant in the world. Among the species recorded, there is only one species which has filiform ascospores. He has considered it as a new species and has described it under the name, *Ophiobolus Oryzae*. His description of the fungus is as follows :—

"Perithecien sind schwarz, dick pseudoparenchymatisch, kugelig oder ellipsoidisch, im Gewebe eingesenkt, mit einer grossen warzförmigen Mündung sich öffnend, ca. 250 μ im Durchmesser, und ca. 300 μ in der Höhe (nebst der Mündung). Schläuche sind cylindrisch, 125–150 μ lang, 8–10 μ breit, 8-sporig. Paraphysen sind fadenförmig, den Schläuchen gleichlang oder etwas länger. Sporen sind fadenförmig, eingebogen und eingedreht, 5–8 septiert, dunkelgelb, 100–130 μ lang, 2–3 μ dick.

Hab. auf Blättern und Spelzen."

This species is related somewhat to the fungus in question, but the dimensions of all parts do not correspond, and the latter are larger as compared with the former.

The other species which drew our serious consideration was *Ophiobolus heterostrophus* DRECH. parasitic on maize in America[2] and Japan.[3] The most

1) Studies on the Parasitic Fungi of Rice in Japan. (In Japanese). (Bot. Mag. Tokyo, XXIII, p. 85–97; 127–145, 1909).
Studien über die Pilze der Reispflanze in Japan. (Jour. Coll. Agr. Imp. Univ. Tokyo, II, no. 4, p. 237–276, 2 pls., 1910).

2) DRECHSLER, C.—Leafspot of Maize Caused by *Ophiobolus heterostrophus*, n. sp., the Ascigerous Stage of a *Helminthosporium* Exhibiting Bipolar Germination. (Jour. Agr. Res. XXXI, no. 8, p. 701–726, 5 figs., 1925).

3) NISHIKADO, Y.—On the Helminthosporiose of Maize. (In Japanese, with MIYAKE, C.). (Jour. Pl. Protect. XIII, p. 20–27, 1926)—Studies on the Helminthosporiose of Maize. (In Japanese, with MIYAKE, C.). (Nogyo Kenkyu, VIII, 56 ps., 2 pls., 1926)—Studies on two *Helminthosporium* Diseases of Maize Caused by *Helminthosporium turcicum* PASSER. and *H. Maydis* n. sp. (In Japanese). (Morioka Kono Dosokwai Gakujutsu Iho, III, 37 ps., 1926)—On the Leafspot Disease of Maize. (In Jour. Pl. Protect XIII, p. 276–279, 1926)—Studies on two Helminthosporium Diseases of Maize, Caused by *Helminthosporium turcicum* PASSERINI and *Ophiobolus heterostrophus* DRECHSLER (=*H. Maydis* NISHIKADO et MIYAKE). (With MIYAKE, C.). (Ber. Ohara Inst. Landw. Forsch. III, p. 221—266, 6 pls., 1926).

noteworthy characteristics of the ascigerous stage of the maize-fungus, in regard to the disposition of the ascospores in a well defined spiral as well as to many other characters, correspond very well with those of the rice-fungus under consideration, except only the dimensions of all parts are larger in the latter. Thinking some fluctuation in dimension might be caused by the cultural condition, we endeavored to get the ascigerous stage on the remains of rice-plant in the heavily attacked rice-field in the previous year, but this labour was not rewarded up to the present. The conidial stage of the maize-fungus is a *Helminthosporium* which belongs to the group of curved elliptical conidia germinating by two polar germ-tubes, like *Helminthosporium Oryzae*. DRECHSLER conducted the inoculation-tests with the conidia of the maize fungus and observed that "a sparce scattering of minute blackish specks appeared" on rice-foliage, but "the spots, however, increased neither in size nor in number." NISHIKADO also proved that the infection occurs on rice-plant by the conidia of the maize-fungus, but in very slight degree. On the other hand, SUEMATSU and ŌKADA[1] succeeded to infect maize-plant by *Helminthosporium Oryzae*. We have also tried some inoculation-tests on maize- und rice-foliage by the application of the conidia of the rice- and maize-fungus reciprocally. In these cases, minute translucent scattered spots of incipient infection appeared on the leaves of both plants (Pl. II, fig. 1a & 2b), showing that each host is immune to the reciprocal fungus. In contrast to the vigorous parasitism of each fungus on its proper host plant (Pl. II, 1b & 2a), it is, therefore, reasonable to consider them as independent species. The idea is strengthened further by the distinct morphological difference of their conidia, as shown in Plate III.

As DRECHSLER has already discussed, in the absence of a more appropriate genus for the fungus which produces such peculiar helicoid ascospores, the rice-fungus is also tentatively assigned to the genus *Ophiobolus*, as a sister-species of the maize-fungus. The production of such ascigerous stage in the culture of *Helminthosporium Oryzae* seems to support his view that the species of *Helminthosporium* exhibiting bipolar germ-tubes constitute a natural group distinct from the group of species with straight conidia germinating laterally.

As the name *Ophiobolus Oryzae* is already occupied as above mentioned,

1) On the Relation between Grasses and *Helminthosporium Oryzae*. (In Japanese). (Jour. Sci. Agr. Soc. Tokyo, no. 214, p. 443–446; no. 217, p. 655–657, 1920).

we wish to propose here a new name *Ophiobolus Miyabeanus* for the present fungus. The species is named in honour of Prof. Dr. KINGO MIYABE.

Ophiobolus Miyabeanus n. sp.

Syn. *Helminthosporpum macrocarpum* THÜM. (not GREV.) Die Pilze der Reispflanze (*Oryza sativa* LIN.), s. 15, 1889.

H. Oryzae BREDA DE HAAN, Bull. L'Inst. Bot. Buitenz. VI, p. 11, 1900.

H. Oryzae MIYABE et HORI, Rep. Centr. Agr. Exp. Sta. Tokyo, XVIII, p. 67–81, 1901.

Conidial stage=*Helminthosporium Oryzae* BREDA DE HAAN.

Ascigerous stage—Perithecia black, thin pseudoparenchymatous, globose or depre sed globose, with ostiolar beak, 560–950=368–777 μ. Asci numerous, cylindrical or long fusiform, 142–235=21–36 μ, with 1 to 8, mostly 4 or 6 ascospores. Ascospores filiform or long cylindrical, coiled in a close helix, 6–15, mostly 9–12 septate, hyaline or light olive green in color, 250–468=6–9 μ.

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University, Sapporo, Japan.

EXPLANATION OF FIGURES.

PLATE I.

Fig. 1. Perithecium of *Ophiobolus Miyabeanus*.

Fig. 2. Four mature asci.

Fig. 3. a. Ascospore with a mucous envelope.
b. Two ascospores.
c. Three germinated ascospores.

PLATE II.

Fig. 1. a. Two maize leaf-blades inoculated with the conidia of *Ophiobolus Miyabeanus*.
b. Two maize leaf-blades inoculated with the conidia of *Ophiobolus heterostrophus*.

Fig. 2. a. Three rice leaf-blades inoculated with the conidia of *Ophiobolus Miyabeanus*.
b. Three rice leaf-blades inoculated with the conidia of *Ophiobolus heterostrophus*.

Fig. 3. Showing the perithecia of *Ophiobolus Miyabeanus*, which were formed on rice-culm decoction agar.

PLATE III.

Fig. 1. Twenty four conidia of *Ophiobolus Miyabeanus*.

Fig. 2. Fifteen conidia of *Ophiobolus heterostrophus*.

摘　　　要

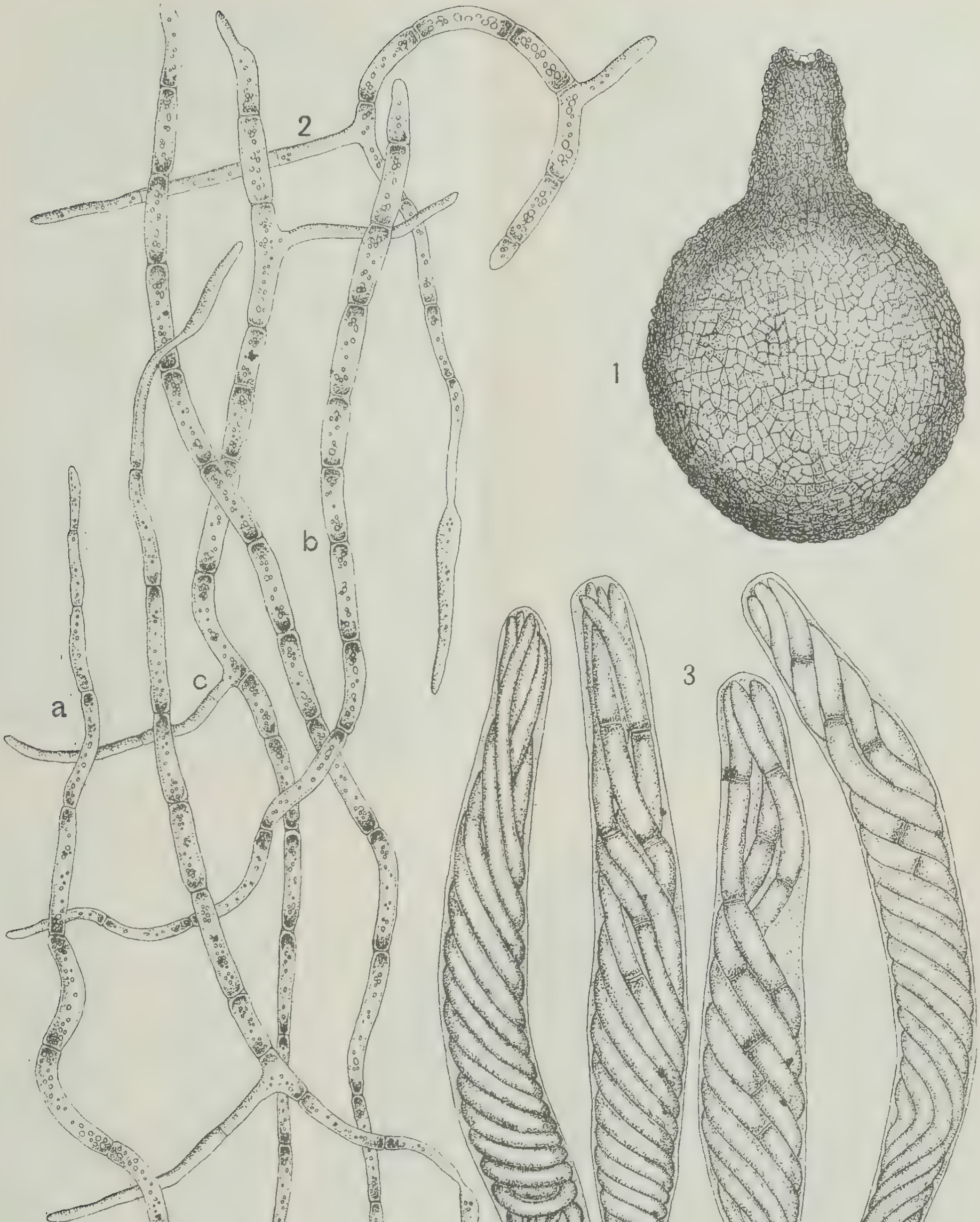
稻胡麻葉枯病菌培養中往々小形黑色菌核狀物の形成せらるゝは從來認めつゝある事實なれ共、未だ本菌子嚢時代を知られざりき。偶々銹米調査中穀粒より分離せる本菌に於ては葉片より分離せるものの多く不完全なるに反して完全なる子嚢時代を形成することを認めたり。

子嚢殼形成には稻藁煎汁寒天培養基最も好適し、最適溫度は約二十五度なるが如し。培養四五日にして小白塊を菌絲中に認む。該塊漸次擴大し中心に黑點を有する灰色塊となり、培養器裏面より覗ふときは黑點となりて見ゆること第二圖版第三圖に示すが如し。子嚢殼は約十五乃至二十日にして、子嚢は大部分二十五乃至三十五日にて成熟す。

子嚢殼は黑色、薄擬柔組織よりなり、球形或は扁球形にして、嘴部を有す。高さ 560–950μ, 幅 368–777μ あり。子嚢多數にして圓筒形又は長紡錘形、內に一乃至八個、多くは四個又は六個の子嚢胞子を藏す。長さ 142 乃至 235μ, 幅 21 乃至 36μ あり。子嚢胞子は糸狀又は長橢圓形にして螺旋狀に捲曲す。六乃至十五、多くは九乃至十二の隔膜を有し、無色或は淡オリーブ色を呈す。長さ 250 乃至 468μ, 幅 6 乃至 9μ あり。

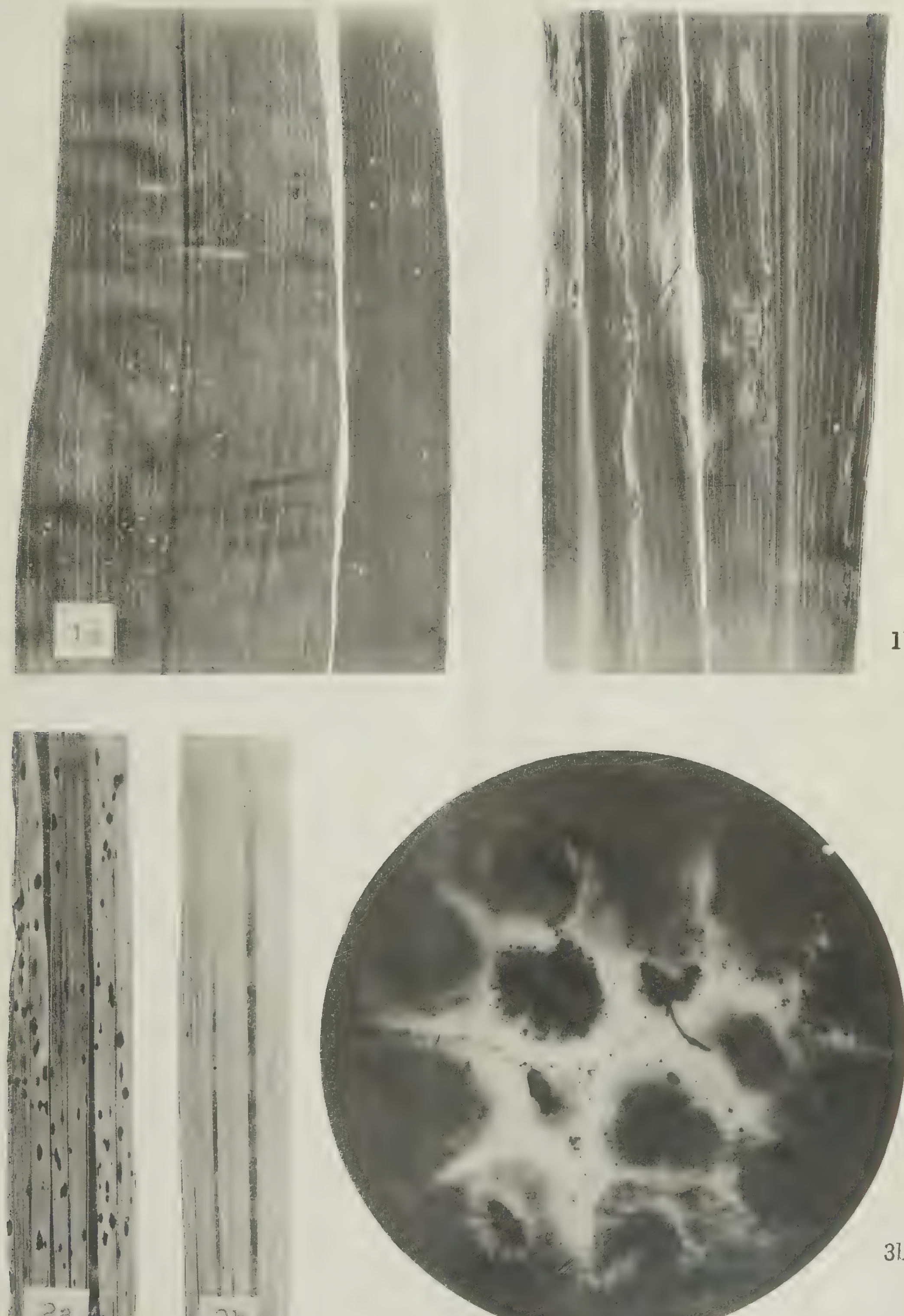
本子嚢殼の形態は極めて善く玉蜀黍斑點病菌 Ophiobolus heterostrophus Drech. のそれに類似するも其大さに於て異なり、又兩菌の分生胞子の形態は明かに異なりあり。尙交互接種試驗を行ふも只小形の斑點を生ずるのみにして自然界に於て發病せしむるが如きことなきを認めらる。依りて之れを別種と認むるの妥當なるを信ず。而して本菌を Ophiobolus 屬に納め、其種名として分生胞子時代の種名を採用するを至當とするも、已に本菌と異なる菌に同名のものあるにより、玆に新名 Ophiobolus Miyabeanus を附せり。

Plate I



Kuribayashi deL

Plate

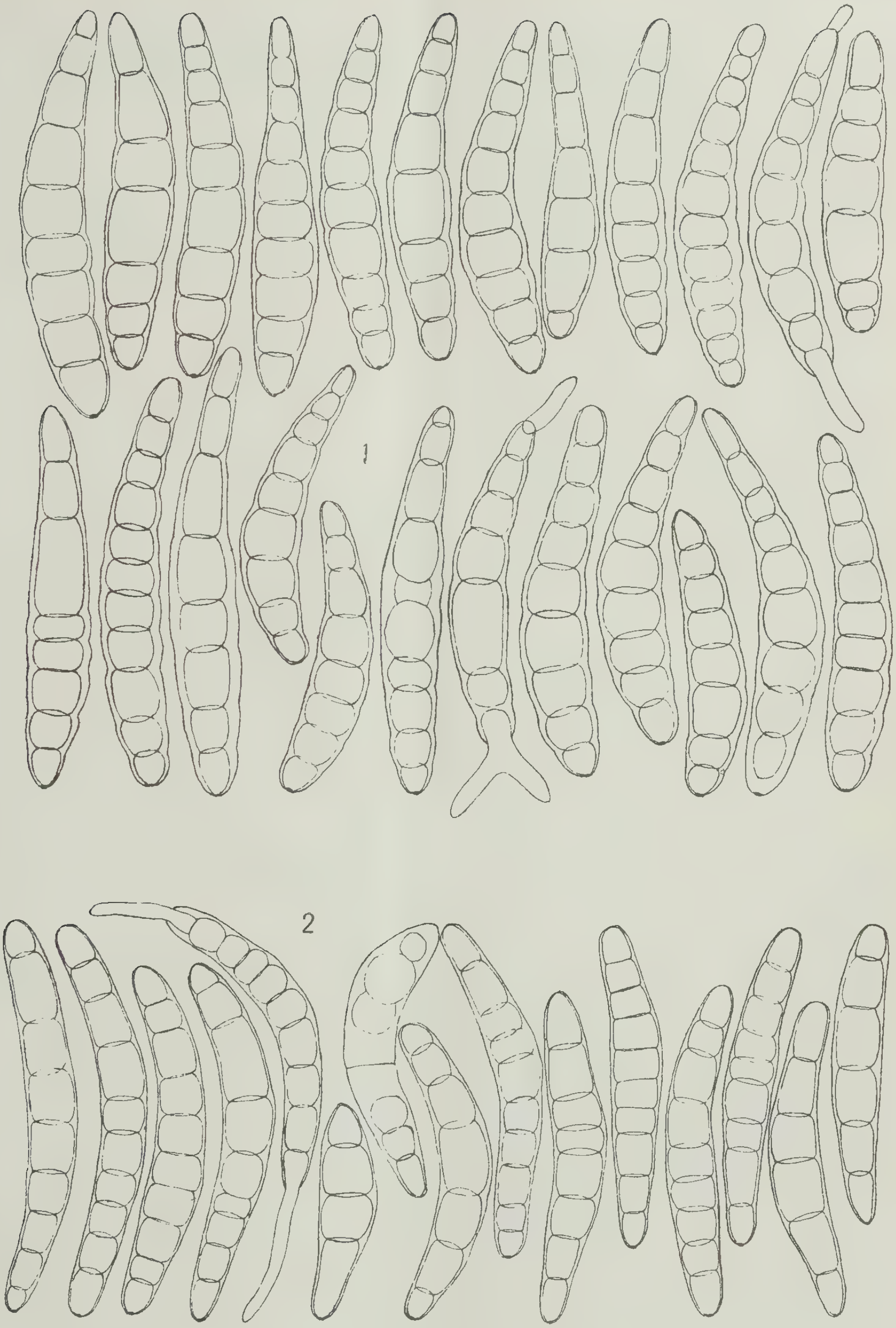


1b

3b

Suzaki phot.

Plate III



Kuribayashi del.

稻不定性病害に關する實驗的研究の概要

逸 見 武 雄

AN OUTLINE OF THE EXPERIMENTAL STUDY ON THE "INDEFINITE" DISEASES OF THE RICE PLANT*

by

Takewo Hemmi

It is a well known fact that seed and soil-inhabiting fungi cause serious damage to the wheat and other cereal crops. Since Bolley (1—4) conceived of the problem on the root and foot rots of cereals in its broad aspects and called attention to its seriousness, many pathologists have supported his ideas (5, 11, 12, 17). Owing to the accumulation of fungi in the soil such damage is very serious, gradually producing more dangerous diseases each year because of the system of continuous cropping of one particular kind of cereals. Such diseases have been grouped as the "indefinite" diseases of cereals. Recently the writer and his coworkers (7—9) defined the term as meaning the injury that disturbs the germination of the seeds and the growth of the seedlings.

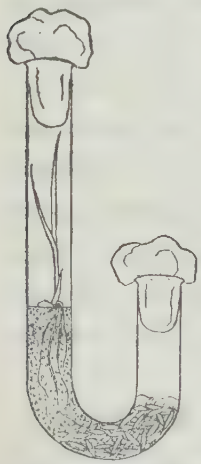
For a long time it has been a puzzle to the writer, that such a problem on the rice field has not yet been accurately discussed by any pathologists as well as mycologists. The methods of cultivation of the rice plant is quite different from that of other cereals and the proper preparation of the land for the seedlings to be transplanted is most important to obtain the strong and healthy plants. Several workers have already discussed the quality of different kinds of seedbeds from various points of view. It has been, however, quite neglected to investigate the rice seedbeds from the phytopathological standpoint. The experimental studies on the pathogenicity of the fungi which have the possibility to be associated with the seed and soil are, therefore, not only of scientific interest but also of practical importance.

In order to solve the problem the isolation of the fungi was begun in

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*Contributions from the Loboratories of Phytopathology and Mycology, Kyoto Imperial University, Kyoto, Japan. No. 4. This paper is to be read at the third pan-pacific science congress.

April, 1925, and continued for approximately a year and a half. Cultures were secured from the seeds, roots, culms and leaves of the rice plant, from the corresponding parts of other cereals, from the soil and also from germinating rice seeds. In order to obtain a preliminary indication of the parasitism of the different cultures, the writer and his coworkers have used four different methods of inoculation. The first method was essentially the same as that used by Stakman (17). Disease-free seedlings were required for this kind of inoculation. When sterile seedlings were prepared by the used of a special method, they were planted in flasks or in tubes of nutrient agar. The fungus to be tested was planted at the same time, or sometimes a few days earlier. The degree of parasitism of the different fungi was then judged by their effect on the development of the seedlings, particular attention being given to the evidences of root parasitism as judged by the stunting, deformity, discoloration, and other conditions of the roots as compared with the white uninjured roots of the controls. The second method employed was newly designed by the writer (10). In this series of experiments the disease-free seedlings were grown on the sterilized soil in the L-shaped tubes shown in Fig. I, where the roots became gradually infected by the fungus to be tested which were previously grown on the chaffs in the bottom of the tubes. In the third and fourth experiments fungi were tested by inoculating the soil in pots or the sand in dishes with their pure cultures, and planting each with sterilized seeds. Since our experiments are now still in progress, the results are not yet conclusive. We can, however, easily recognize the fact that there are a group of fungi causing experimentally the root and foot rots of the rice plant.


Fig. I. L-shaped tube used in the second series of experiments.

According to our experiments some organisms isolated from the leaf and culm such as *Piricularia Oryzae* Br. et Cav., *Helminthosporium Oryzae* Breda de Haan, *Hypochnus Sasakii* Shirai and *Sclerotium Oryzae-sativae* Sawada have power to infect the foot and root of the rice seedlings, although most of them are not virulent root parasites. This fact is very interesting, for they are all very common and most destructive fungi of the rice plant in Japan. Ocfemia (15, 16) has already pointed out the pathogenicity of *Helmin-*

thosporium Oryzae on the root and foot of the rice seedlings. Hara (6) and Nisikado (13, 14) have also recognized its pathogenicity on the seedlings, but did not definitely describe it to be a root parasite. The pathogenicity of *Sclerotium Oryzae* Catt. and also of *Sclerotium Rolfsii* Sacc. on the rice seedlings has been reported by Shaw (18) and Tisdale (19). So far as the writer knows, the pathogenicity of other fungi on the roots of the rice-seedlings is, however, quite unknown.

As an example of the results of our experiments, the records from the first series of inoculation experiments with *Piricularia Oryzae, Helminthosporium Oryzae* and *Hypochnus Sasakii* are summarized in the following table.

Fungus inoculated	Treatment of Seeds	Number of Plants		Average Length of Leaves and Culms		Average Length of Roots	
		Inoc.	Check	Inoc.	Check	Inoc.	Check
Piricularia	Hulled	40	41	9.19	13.74	6.63	7.89
Oryzae	Unhulled	72	64	8.33	11.55	6.09	7.63
Helmintho-sporium	Hulled	40	39	6.28	13.74	6.31	7.89
Oryzae	Unhulled	74	66	6.03	11.55	5.61	7.63
Hypochnus	Hulled	64	51	13.23	15.42	9.19	8.64
Sasakii	Unhulled	54	56	9.06	11.83	6.45	7.73

It would be expected that there would be many fungus spores on the surface of the rice seeds. Isamu Matsuura, one of the writer's coworkers, isolated several strains of such fungi having all practically similar morphological characters which seem to us to belong to the genus *Brachysporium,* and studied their pathogenicity on the root and foot of the rice seedlings. They were all proved to be the serious parasites. According to the writer's investigation *Gibberella saubinetii* (Mont.) Sacc. and other *Fusarium spp.* in the conidial form are found very common on various parts of the rice plants in Japan, and they are very destructive to the root and foot of the rice seedlings.

These results of our experiments will be published in detail later by the writer and also by his students. At any rate our results lend support to Bolley's contention that such root parasites contribute materially to the deterioration of cereal yields. The observation on the pathogenicity of those fungi on the seeds and seedlings in the seed beds under natural condition is not yet done, but it may be safely presumed that the rice seedlings have the tendency to be attack-

ed by many fungi, if they are planted to the seedbeds favorable for the fungus growth. While we are not justified to state that the root-rotting fungi are the only cause of reduced cereal yields on the land cropped more or less constantly to one kind of plants, we can at least say that they constitute an important contributing factor in this reduction. Investigations along this line are, therefore, very important to the agriculturists in the rice growing countries.

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太平洋沿岸諸國に於ける稻胡麻葉枯病の比較研究。

西 門 義 一

COMPARATIVE STUDIES ON HELMINTHOSPORIUM DISEASES OF RICE IN THE PACIFIC REGIONS.

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I. Introduction.

The rice disease termed "Gomahagare-byo" or the sesame-like leaf spot has been known as one of the most serious diseases of rice in Japan. It is caused by the fungus *Helminthosporium Oryzae* Breda de Haan. The disease attacks all parts of the rice plant in all the stages of the development.

The causal fungus of the disease was first described in Java by Breda de Haan under the name *Helminthosporium Oryzae* n. sp. in 1900. In the next year an authentic report upon this Helminthosporum disease was published by S. Hori (1901), who found the causal fungus in 1892. In his paper he gave a new name *Helminthosporium Oryzae* Miyabe et Hori to the causal fungus. At present, however, the causal fungus is known under the name of Breda de Haan for the reason of priority.

Although the causal fungus was first described in Java the disease and the fungus have been studied most in Japan. Besides S. Hori, the disease was studied by G. Kurosawa (1911), G. Yamada (1911), I. Miyake (1910), K. Hara (1916), N. Suematsu (1919-21) and Y. Nisikado and C. Miyake (1918-1922) etc.

The occurrence of the Helminthosporium disease of rice has been reported from Italy (by Farneti, 1906), the Straits and Federated Malay (Gallagher, 1908), India (Sandararamann, 1922), Ceylon (Bryce, 1921), Uganda in East Africa (Snowden, 1921), Cochin-China (Vincens, 1921), Philippines (Reinking, 1919, Ocfemia 1924) Southern China (by correspondence) and North America (Drechsler, 1923; Tisdale and Ocfemia, 1924)

As stated above the Helminthosporium disease of rice has been reported from almost all the rice growing regions of the globe. The specific identifica-

1) The writer wishes to express his appreciation to Mr. C. Miyake, for his helps throughout the experiment, to Prof. Dr. S. Kusano, for his kind suggestion, to Dr. C. Drechsler for his advice and criticism, and to Dr. G. O. Ocfemia and Dr. Van Hall for culturres.

tions of the causal fungus in various localities have not yet been validly decided. In some papers the causal fungus was reported as an unidentified species of Helminthosporium. Even in papers treating *Helminthosporium Oryzae* there is a great divergence among the shape of the spores and mycelium etc. of the causal organisms.

For a long time I have been devoting myself to the studies of the diseases of cereals and grasses caused by the genus Helminthosporium. Therefore, comparative studies of the various strains of *Helminthosporium Oryzae*, obtained from various rice growing localities bordering the Pacific Ocean, were started to contribute to the knowledge upon the distribution of the disease. For this purpose, pure cultures of the Helminthosporium of rice from North America, Philippines and Java were obtained through the courtesy of Dr. G. O. Ocfemia and Dr. Van Hall etc.

At the start of this experiment the following four strains were compared: viz.

Japanese strain, No. 45. & No. 234. isolated by the writer in Kurashiki.

American strain, No. 195 & No. 197. isolated by Dr. Tisdale in Lousiana, U. S. America.

Philippine strain, No. 196. isolated by Dr. G. O. Ocfemia.

Javanese strain, No. 198. isolated by the writer from Javanese specimen send by Dr. Van Hall.

Of these four strains, those obtained from Philippines and Java have failed to produce the spores. Moreover I was informed that there were no sporulating strains of the cultures of Helminthosporium of rice in those regions, though in Ocfemia's paper (23) he reported the spore formation of the strains of Philippine origin on certain culture media. The study on the comparative morphology, therefore, was compelled to restrict between the Japanese and the American strains, which produced the spores in ordinary cultural conditions.

II. Morphology.

1. Lesions.

Both the American and Japanese strains were inoculated on rice seedlings with the spores sprayed by atomizers. After 2 or 3 days' incubation, characteristic lesions appeared on the sprayed leaves. The lesions produced by the infection of both the Japanese and the American strains were almost similar in shape, size and color. It seems correct to consider that there are no dif-

ferences between the lesions caused by these two strains, at least, in the case of seedling infections.

At first, small, brown and circular or oval spots were produced abundantly on every parts of leaves. The progress of the disease was very rapid, and abundant lesions were produced within only two or three days. Each spot, however, enlarged gradually, and became 1.5—2.0 millimeters long, 0.5—1.0 millimeter wide and dark brown.

On the glumes, the Japanese strain presented one of the most attractive and well-known symptoms. In the advanced stage, the infected glumes seemed to be covered with dark brown hairs.

2. Mycelium.

The mycelium of the Japanese strain developed in Hopkin's agar medium at a temperature of 27°C. is recorded in this place for example. It was hyaline or light olive, and coarse granulated, the granules being yellow. The hyphae were more or less constricted at the septum, and branched profusely. They were 5—7.5 microns wide and septated at a distance of 12—25 microns.

The mycelium of the American strain in the medium, was almostly hyaline, thin-walled, and provided with pretty large, olive-green granules. The hyphae were slightly slender than those of the Japanese strain, and 2.5—6.5 microns wide. They were slightly constricted at the septum.

3. Conidiophores.

Conidiophores of the Japanese strain were stout and erect, and deep olive, though the apices were light colored. They were generally not constricted at the septa, and provided with the basal cells swollen. (Fig. 3)

The conidiophores of the American strain were similar in shape to those of the Japanese strain, but they were somewhat smooth and slender. (Fig. 4)

4. Spores.

Although I have inspected a great many number of spores of the Japanese strain of *Helminthosporium Oryzae* developed on the host plant in nature, I haven't yet taken the chance to observe personally a number of the spores of the American strain developed in nature. The following morphological comparisons are, therefore, limited to those formed on culture media.

The shape of the spores varies greatly according to the conditions under which they are produced. As a representative the spores produced on Hopkins' agar medium are described in this place. The spores of the Japanese strain were obclavate, broadest at the point of one third from the base, and tapering toward both ends. They curved to one side, somewhat irregularly. The hilum, or the scar, was generally protruding, though it was not very large. The spores were not constricted at the septum, and provided with granular contents.

The spores of the American strain differed greatly from those of the Japanese strain. They were fusoid to cylindrical, broadest at the middle part, and tapering gradually toward both ends almost equally. They curved to one side prominently. They were dark olive buff or deep olive buff in color. The hilum was very small and only about 1 micron wide, and sunken within the contour of the spore. The spores germinated very readily from the end cells, and rarely from the other.

As shown in the photomicrographs and the figures in the Plate, the conidia of the both starins showed clear differences between them. The differences were also demonstrated biometrically.

Results of biometrical studies on the spores developed on Hopkins' agar medium at various temperatures are given in Table I.

Table I: Summary of comparative measurements for length, width and septation of spores of the Japanese and the American strains of *Helminthosporium Orýzae*, developed on the Hopkins' agar.

Strain	Temperature	No. measured	Range	Mode	Mean	Standard deviation	Variation coefficient
Length of Spores in Microns.							
Japanese	15°C.	500	40.80–124.95	81.60	82.12±0.38	12.60±0.27	15.34±0.36
	22°C.	500	48.45–124.95	89.25	93.94±0.38	11.57±0.27	13.38±0.29
	27°C.	500	45.90–124.95	89.25	89.46±0.34	11.13±0.24	12.44±0.27
American	15°C.	500	28.05–124.95	81.60	80.34±0.54	17.72±0.39	22.03±0.47
	22°C.	500	33.15–145.35	107.10	103.90±0.48	16.15±0.35	15.63±0.34
	27°C.	500	45.90–140.25	107.10	103.13±0.60	19.99±0.33	19.88±0.41
Width of Spores in Microns.							
Japanese	15°C.	500	11.48–22.95	17.85	17.03±0.04	1.30±0.03	13.10±0.28
	22°C.	500	10.20–21.68	17.85	17.35±0.06	1.87±0.04	10.78±0.23
	27°C.	500	11.48–20.40	17.85	16.87±0.06	1.96±0.04	11.57±0.25
American	15°C.	500	10.20–20.40	15.30	15.33±0.05	1.57±0.03	10.20±0.22
	22°C.	500	10.20–22.95	15.30	15.69±0.04	1.40±0.03	8.91±0.19
	27°C.	500	10.20–24.23	15.30	14.98±0.05	1.51±0.03	10.04±0.21

Number of Septa of Conidia.

Japanese	15°C.	500	3−10	7	6.82±0.04	1.29±0.03	18.90±0.42
	22°C.	500	4−11	8	7.84±0.03	1.07±0.02	13.65±0.30
	27°C.	500	3−10	8	7.50±0.04	1.25±0.03	16.59±0.36
American	15°C.	500	1−11	7	5.86±0.05	1.78±0.04	30.30±1.60
	22°C.	500	2−12	8	7.50±0.04	1.39±0.03	18.45±0.41
	27°C.	500	2−12	7	7.02±0.04	1.41±0.03	20.07±0.45

As shown in the above tables the mean values of 500 measurements of the spores of the Japanese strain developed on Hopkins' agar medium at 22°C. were 93.94±0.38 microns for length, and 17.35±0.06 microns for width, and at 27°C., 89.46±0.34 microns for length and 16.87±0.06 microns for width. While those of the American strain at 22°C., were 103.90±0.48 microns for length, 15.69±0.04 micrans for width, and at 27°C., 103.1340.60 microns for length and 14 98±0.05 microns for width. In short these figures show that the spores of the American strain are much more slender tnan those of the Japanese strain.

The mean values for number of septa of spores of the both strains showed no great divergence between them, and were about 7, with the exception of those produced at a temperature of 15°C.

III. Physiology.

In this place only the results of cultural studies of the Japanese and the American strains on culture media containing various carbon sources, and the thermal relations are briefly reported.

1. Comparative growth on culture media containing various carbon sources.

The growth of these strains on culture media containing various kinds of carbon sources was studied. Two percent. of various sugars and higher alcohols were added to the standard nutrient solution, which were prepared after the formula of Hopkins, the constituents being as follows:

KNO_3	2.0 gms.
$MgSO_4 + 7H_2O$	0.5 ,,
KH_2PO_4	0.1 ,,
Distilled water	1000 cc.

In our laboratory the nutrient solution of the above constituents with ad-

dition of 1% of glucose, has been called Hopkins' nutrient solution. Fifty portions of the solutions were placed in each of Erlenmeyer's flask of 200 cc. capacity, and sterilized in Koch steam sterilizer. They were inoculated and incubated at 25–26°C, for 10 days. Then the mycelial mats were removed and filtered, dried in steam bath and wighed to constant weight. The results are given in the following table:

Table II: Growth of various strains of *Helminthosporium Oryzae* in culture solutions containing various carbon sources.

Kinds of carbon sources	Japanese strain (No. 234)		American strain (No. 195)		Javanese srrain (No. 198)	
	A. D. W. M.	Spore	A. D. W. M.	Spore	A. D. W. M.	Spore
Glucose	0.1772 gm.	***	0.2831 gm.	**	0.2020 gm.	–
Laevulose	0.2846 „	***	0.3226 „	**	0.3552 „	–
Sucrose	0.1771 „	***	0.3150 „	**	0.1454 „	–
Malrose	0.3290 „	***	0.2817 „	*	0.2549 „	–
Lactose	0.0436 „	***	0.1224 „	–	0.0680 „	–
Soluble starch	0.2472 „	***	0.2647 „	*	0.2228 „	–
Glycerine	0.0141 „	**	0.0357 „	–	0.0589 „	–
Mannite	0.0158 „	**	0.1030 „	–	0.0956 „	–

Remarks: In this table A. D. W. M. means 'Average dry weight of mycelium yielded in a flask'. The sign* means the spores are produced and sign—no spore formation.

As shown in the foregoing table, the mycelial growth of the Japanese strain was best in the solutions containing maltose, and very poor in mannite and glycerine. Kinds of carbon sources seemed to show a great influence upon the mycelial growth, but a little upon the spore formation. In all the solutions tested the spores were produced copiously. White masses of mycelium were observed in some parts of the colonies. The shape of the spores developed on these media was almost similar, except the case of laevulose.

The growth of the American strain was best in the medium containing laevulose and very poor in glycerine and mannite. White, copious masses of aerial mycelium were formed on all the surface of media. The spore formation varied according to the kinds of carbon sources. In general appearance the American strain differed greatly from the Japanese strain. The Javanese strain were similar in general appearance to the Japanese strain, except that the former strain did not develop the spores. Mycelial growth was not very good.

2. Thermal relations

To test the thermal relations of the Japanese and the American strains of *Helminthosporium Oryzae*, bits of agar cultures of both strains were transferred to the center of agar plates of Hopkins' agar medium in Petri dishes, each containing 20 cc. of the medium. Then they were incubated at various temperatures. After 2, 4 and 6 days' incubations the diameters of the colonies were measured. The results are given in the following table:

Table III: Comparative growth of colonies of the Japanese and the American strains of *Helminthosporium Oryzae* on Hopkins' agar at various temperatures.

Teperatures	Japanese strain (No. 45)		American stranin (No. 195)	
	After 2 days	After 4 days	After 2 days	After 4 days
15–16°C.	7.7 mm.	16.5 mm	8.6 mm	17.6 mm
21–22°C.	15.3 "	38.2 "	13.7 "	29.8 "
26–27°C.	19.1 "	53.6 "	19.5 "	40.1 "
32–33°C.	9.1 "	21.7 "	20.3 "	40.3 "

According to the results, the growth of the American strain at highter temperatures was much better than that of the Japanese strain. And the optimum temperature for the mycelial growth of the former strain seemed to be 2–3 degrees higher than the latter.

IV. Pathogenecity.

For the comparisons of the pathogenecity of the Japanese and the American strains of *Helminthosporium Oryzae*, inoculation experiments of these strains upon rice seedlings of various varieties were prosecuted. For the inoculations both the Japanese and the American strains were grown on agar plates of rice decoction agar media in Petri dishes, in an incubator set at 26–27°C. The spores produced on these culture plates were rubbed off and secured from the plates and suspended in sterile dilute rice decoction. They were applied with atomizers to the rice seedling to be tested, under an infection cage in the greenhouse.

The seedlings tested, were grown in ordinary seed beds in the field. When they grew to 4–5 inches long, they were transferred to glass bottles. In each bottle, 2 or 3 seedlings of a variety were inserted. Three lots of these seed-

lings of a variety were established, namely, (1) Rice seedling were sprayed with the spores of the Japanese strain; (2) Rice seedlings were sprayed with the spores of the American strain; and (3) The control, where the seedlings were prepared as above, but no spores were applied.

About 480 varieties or strains of rice cultivated in various localities of Japan and the other countries were inoculated. Among these varieties, or strains, 3 were secured from Hawai; 6 from Korea; 10 from Formosa; 19 from China and 6 from Java. Almost all the varieties tested, were infected with the strains. The inoculation experiments were repeated triplicately in our laboratory, and the results were similar. According to the results of these inoculations, there seems to be no remarkable distinction in the pathogenecity between the Japanese and the American strains of *Helminthosporium Oryzae*.

V. Conclusions.

Variation in the shape of spores of the genus Helminthosporium according to the environments are reported by Dosdall (1923), Enomoto (1925) Nisikado et Miyake (1922) and others. As stated above, however, there is a pretty divergence in the shape of spores of the fungus known under the name *Helminthosporium Oryzae*. And the contrasts between the Japanese and the American strains are very clear, even between those grown in the same environments.

Although the above investigation has almostly been done upon only 2 strains of the Japanese and the American strains, there appears to be good reason to believe that they represent the strains of the both countries. The spores of the Japanese fungus of *Helminthosporium Oryzae* on rice plant in nature are similar to those of the strain No. 45 developed on rice agar or Hopkins' agar at 20–27°C., on the other hand, the above given descriptions of the American strain coincide very closely with the descriptions and the figures given by C. Drechsler (1923) and G. O. Ocfemia (1924). The cultures investigated by C. Drechsler, G. O. Ocfemia and by me are, however, all originated from strains secured by W. H. Tisdale in Louisiana, U. S. A., in 1920. Therefore, besides these strains, there may possibly exist some other strains, which may be similar to the above stated Japanese strain. Yet the above recorded strain of the

American fungus, should differ from the fungus commonly known in Japan, at least, from our strain No. 45.

As to the comparisons of these strains little work has been done. After describing finely the American fungus of *Helminthosporium Oryzae*, C. Drechsler (1923) compares it with the Japanese fungus through the descriptions and figures given in the writer's paper (1922), and states as follows:

"Their (meaning Nisikado and Miyake) full account of the morphology, pathogenecity, and cultural characters of the fungus, and their abundant illustrations, leave no doubt that the parasite found destructive in Japan and presumably in many other rice-growing countries of the Orient is altogether identical with the one discussed in the foregoing paragraphs. The lack of close agreement in measurements of conidia and conidiophores given by different authors would seem to be due in large measure to the variability of the fungus under different conditions of growth both in nature and more especially in artificial culture."

Moreover, upon the strains of *Helminthospovium Oryzae*, G. O. Ocfemia (1924) discusses as follows:

"In the present studies the writer concludes that the Louisiana and the Philippine strains are identical with each other and with the Japanese fungus. Since the Japanese fungus is identical with that described by Breda de Haan in Java, the four strains belong to the same species."

Ocfemia showed clear contrasts between the Japanese and American strains in his figures in Plate XXVI. Notwithstanding the great variation in the spore shape of species of Helminthosporium, the above results show that the Japanese and the American strains must be morphologically distinct forms, and may possibly be different species.

VI. Summary

1) In this paper are given results of comparative studies on various strains of *Helminthosporium Oryzae* Breda de Haan, causing leaf-spot disease of rice in the Pacific regions. Compariosns were especially made between the Japanese and the American strains, which produced the spores in cultural conditions.

2) The lesions on the rice plant, produced by both the Japanese and the American strains, are similar in general appearance.

3) Both the strains show clear contrasts in the morphological characters, especially in the shape of spores. The spores of the Japanese strain are obclavate, broadest at the point of one third from the base, provided with pretty large, prominent hilum. While those of the American strain are cylindrical or fusiform, broadest at the middle part or the point of two thirds from the base, curved to one side regularly, the hilum being small and less prominent. The general shape of the spores of the latter is much more slender than the former.

4) Not only morphologically but also physiologically the both strains show differences between them.

5) The both strains were inoculated on the seedlings of about 480 varieties or strains of cultivated rice. The results show that there are no great divergence between both strains regarding the pathogenecity to the rice seedlings.

6) The above stated two strains must be regard as quite distinct forms, and may possibly be different species.

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Plate

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



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摘　　要

(1) 本報告は太平洋沿岸諸國に發生せる稻胡麻葉枯病菌 (*Helminthosporium Oryzae* Breda de Haan) の各種系統に就きて形態生理幷に病理學上より比較研究を試みたる結果なり。特に培養上に於て胞子を形成する日米兩國產菌に就きて精細に比較せり。

(2) 日米兩國產菌により惹起せらるゝ病斑の形狀は略々同様にして兩者の間に大差あるを見ず。

(3) 此等兩菌は其形態的性質特に其分生胞子の形態に於ては、著明なる差を有する物なり。日本產菌の分生胞子は倒棍棒狀にして基部より三分の一附近に於て最も太く且つ臍は稍々大形にして突出せり。之に反して米國產菌は圓筒又は紡錘形、中央部又は先端より三分の一附近が最も太く其より兩端に向ひて殆んど相稱的に漸尖す。殆んど必ず一方に彎曲す。臍は小形にして餘りに鮮明ならず。概して後者は前者に比して纖細なり。

(4) 單に形態上のみならず生理上に於ても此等兩菌は稍々著しき差を有する物なり。

(5) 此等兩菌を約 480 種の異なれる品種の稻苗に對し接種を試みたり。其結果は兩菌共供試稻苗に對する病原性に於て大差なき物なる事を示せり。

(6) 上記兩系統菌は形態上或は生理上著しき差を有し完く異なる型に屬する物にして或は別種なりと斷ずるも誤りなきが如し。

附言。本報文は大正十五年十月三十日より十一月十日まで東京に於て開催せられる第三回汎太平洋學術會議に於ける講演の原稿を修正したる物なり。

Explanation of Plate.

Fig. 1–2. Spores of Helminthosporium Oryzae Breda de Haan, produced on rice decoction agar at 27°C. Photomicrographed. Magnification × 450.

Fig. I. Japanese strain. Fig. 2. American strain.

Fig. 3–4. Spores of Helminthosporium Oryzae Breda de Haan, produced on synthetic agar medium after Hopkins, at 22°C. Drawn under L. 4 × 7 and reduced about one third. Magn. × 300.

Fig. 3. Japanese strain. Fig. 4. American strain.

稻の一病原菌に於ける突然變異に就きて*

逸 見 武 雄
松 浦 勇

On the Mutation of a Hyphomycetous Fungus parasitic on the Rice Plant*

By
Takewo Hemmi and Isamu Matsuura

目 次

緒 論

突然變異(Mutation)が生物進化の出發點をなすことは今日一般に信ぜらるゝ處にして、高等植物に於ては之が研究結果の發表せられたるもの多しと雖、下等植物特に糸狀菌の如きものに在ては精細なる細胞學的並に遺傳學的研究の容易ならざるに基因し、未だ論議せられたるもの極めて尠し。Stevens の如きは彼の取扱ひたる現象を恐らく *Mutation* と稱す可きものと認めたれども、該菌が有性生殖時代を有するや否や不明にして、且菌類は一般に容易に菌絲の癒着を行ふものなるの故を以て假に Saltation と稱し居れり。而して Dobell(10), Wolf(24), Baur(2) 等に據れば假令如何程微小なる變化と雖、それが次代に傳へられ永久的の變異と認む可きものなれば、これを突然變異と見做す可きものなり。

絲狀菌に於ける突然變異に就きては業に西暦一千九百〇八年より一千九百十二年に亘り Arcichovskij(1), Waterman(23), Schiemann(20) 等の報告せるもの

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あれども、Brierley(7) は前記諸氏の *Aspergillus, Penicillium* 等に關する所論に不備の點あるを指摘し、其後 Stevens(22)も亦夫等が單に環境の影響にあらざるなきかを疑ひたり。斯く從來各種文獻に現はれたる菌類の突然變異中には尙暫く疑團を保留す可きもの尠なからざる可しと雖、輓近 Blakeslee(3)(4), Roberts(19), Bonar(6), Stevens(22), Leonian(16), 並に Christensen(9)等の報告したる所によれば、絲狀菌は培養基上に於て體細胞突然變異 (Somatic Mutation) 卽ち無性的突然變異(Asexual Mutation)とも稱す可き現象を屢々起しつゝあるものなり。Christensen(9) の如きは彼の研究したる *Helminthosporium sativum* P.K. et B. 菌は培養基上に於て菌叢の色、生長の狀態、菌絲の性質、胞子形成の程度等の如き微小なる性質の變化を次代に傳ふる多數の變異菌を得て、夫等の菌の小麥に對する病原性の程度を比較研究したる結果、現に植物病理學上極めて重要視せられつゝある病原菌の寄生性の變化に關する問題を突然變異の事實を以て說明せんとせり。卽ち氏は「菌類は dynamic のものにして、static のものに非らざるを以て、常に變化しつゝあり。從て其結果として吾人に斷へず新問題を提示するものなるべく、突然變異は人工培養に於て屢々示さるゝと同様に、自然界に於ても亦普通に起りつゝあるものと想像せざる可らず。故に如上の問題の最後の解決は容易に達せられざるものと見做す可きなり」と論ぜり。斯の如く植物病原菌に於ける突然變異の研究が漸く病理學的にも重大視さるゝに至りたれども、夫等の實例中 Brierley(7) 及び Bonar(6) によりて報告せられたるものは特に吾人の興味を喚起せり。卽ち前者は常に黑色の菌核を形成する *Botrytis cinerea* Pers. より常に白色の菌核を形成する變異菌を得、後者は常に黑色の菌叢を形成する *Brachysporium trifolii* Kauffman (シロツメクサ及びアカツメクサの葉に汚斑病を基因する菌にして、本邦に於ける該病害の發見は昨大正十四年著者の一人松浦(17)によりて報告せられたり) より全然無色の菌絲よりなる白色菌叢の變異菌を得たりと。

著者等は昨年來稻苗に病原性を有する一種の *Brachysporium* 屬菌に就きて研

究に從事中なるが、曩に Bonar の報告したるところと殆ど同一なる現象に遭遇し、常に暗色の菌叢を形成する菌より、常に無色の菌絲よりなる白色菌叢の菌を得たり。仍て之を恐らく突然變異によるものと認め、爾來該菌と母菌との示す性狀の比較研究を行ひつゝあるを以て、左に既往の成績を報告せんと欲す。

第一章　母菌の系統と變異菌の起源

大正十四年四月予等は岡山縣倉敷町大原農業研究所西門義一氏の好意によりて得たる稻の五品種を使用し、攝氏二十一度乃至二十四度の定温室内に於て發芽試驗を施行したるに種子上に發育せる多數の絲狀菌中特に病原性强く思はるゝ本母菌を發見せり。五月一日單一胞子より Sherbakoff 氏法 (21) に從ひて純粹培養を造り、爾來該菌に就き主として稻苗に對する病原性の研究を繼續中なり。該菌は不完全菌類 (Fungi imperfecti), 線菌族 (Hyphomycetes), 黑色線菌科 (Dematiaceae) に隷屬せしむ可きものにして、其の屬名並に種名に關する分類學的研究は未だ完結せざるを以て次報に讓ることゝす。然れども既往の研究結果より按ずるに *Helminthosporium* 屬に極めて近緣のものなれども、寧ろこれを *Brachysporium* 屬に隷入するを至當とするが如し。予等は該菌研究中形態の該菌に甚だしく類似するも容易に同一種なりと斷定し得ざる數系の菌を分離し得たり。故に予等の研究室に於ては本母菌を假に *Brachysporium* 第一號菌と稱し居れり。夫等他系菌との比較並に病原性に關する詳細なる記錄は他日報告することゝし、爰には省略す。然れども本母菌は稻種子の發芽を害し、又は發芽後間もなき稻苗を侵す性質を具有することは明かなり (12) (13) (14) (15)。

前述の如く本母菌は單一胞子より分離したるものにして、爾來數十回各種培養基上に移植繁殖せしめたれども、總て同一系統の菌なるは論を俟たず。而して本母菌の生活史に就きては未だ判明せざる所尠なからざれども、有性生殖法によりて形成せらるゝ胞子は未だ發見せられず。天然に於ても亦無性的に生活を繰り返しつゝあるものと見做し大過なからんか。本菌の培養基上に於ける繁

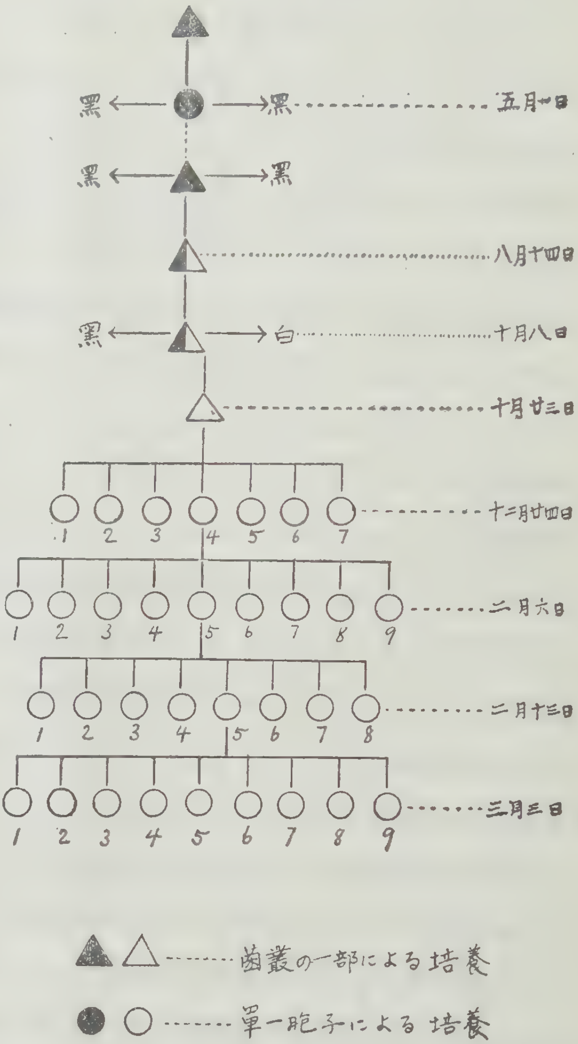
殖は總て無性的榮養器官なる菌絲並に無性的に菌絲の一端又は中間に形成せらるゝ分生胞子又は厚膜胞子によるものなり。

前記の如き母菌を予等の研究室に於て反復移植培養し、大正十四年八月十四日乾杏煎汁寒天培養基の數十本に移植したるものを十月八日に檢査したるに一本丈が斜面の底部約一糎半程白色菌叢を生じ、正常なる發育をなせる黑色菌叢を被覆するを認めたり。而して他の部分には正常なる暗色分生胞子多數に形成せられたるを見たり。仍て十月八日直に前記白色菌を出來る丈け黑色菌絲の混入せざる樣に取りて三本の乾杏煎汁寒天斜面培養基に移植したるに、これより發育したる菌叢は殆ど白色を呈したれども、尙一部分に黑色菌叢を混ぜり。これ移植に當り完全に白色部のみを採取すること困難にして、黑色菌叢の一部が伴はれたるによるものなる可し。十月二十三日に更に白色菌叢を取りて第二回移植を馬鈴薯煎汁寒天及び乾杏煎汁寒天の斜面培養基二十本に試みたるに、盡く白色菌叢のみを生ぜり。而して菌叢の一部分を取りて檢鏡したるに菌絲、擔子梗、分生胞子等何れも其の形態が黑色母菌と大差なく、唯全く無色なるの點に於てのみ異るを見たり。加之此白色菌は培養基上に矢張白色にして、稍々肉色を帶べる所謂 Stalked Body なる特別の器官を形成せり。母菌が黑色の Stalked Body を形成することは本菌の一種の特徵にして、白色菌が色のみを異にしたる同一器官の形成をなしたるは其の不純物として混入したるものに非ざることを示すものと云ふ可し。如何となれば Stalked Body の形成は菌類中の特別の種類のみが示す稀なる現象なればなり。予等は其後數代此白色菌を各種の培養基に移植し、本論文に記すが如き實驗に供したれども、現在に至る迄依然として白色の性質を失はざるものなり。

予等は次に白色變異菌の菌叢に生じたる無色の分生胞子を用ひ、單一胞子分離法によりて四代迄移植を繼續したれども、依然として白色の新性質を保留せり。今移植系統を略圖を以て示せば次の如し。

以上の事實より見る時は白色菌は恐らく黑色菌より突然變異により生じたるものにして、白色の性質を幾代も保留する點より見て、環境の影響による變異に非らざるを知る。突然變異は通常生殖細胞に起るものなれども、他の細胞卽ち體細胞に於て起ること亦決して稀ならず。高等植物に於ける枝變り又は芽變りと稱する現象これなり。而して予等の菌に於ける場合を見るに菌絲の或細胞に突然變異の起りたるものなるや、分生胞子に起りたるものなるやは全く不明なれども、何れも生殖細胞と稱すること能はざるは明にして、若し予等の信んずる如く正に突然變異と斷定し得るものとせば、高等植物の枝變り又は芽變りの現象に相當するものと見做さゞる可らざる可し。曩に Bonar (6) はツメクサ類の汚斑病菌 *Brachysporium trifolii* Kauff. を分離後二箇年間純粹培養せしものが燕麥粉煎汁寒天培養基上に於て一本丈け白色氣中菌絲を生じたるを認めたり。氏は又この變異せる白色菌は最初母菌と同樣暗黑色の Stalked Body を生じたるも、後には全く黑色を消失したる白色乃至淡褐色の Stalked Body を生ずるに至りし旨を報ぜり。氏は此

第一圖　白色變異菌發生系統圖



白色の Stalked Body を取り、よく洗滌して黑色なる母菌の胞子着生を防止しこれを培養基に移植して、純粹なる白色菌を分離し得たり。この變異せる白色菌の生じたる分生胞子は其大さ、形態共に母菌のそれと異ならざるのみならず、これより單一胞子分離法によりて培養したるものも亦依然として白色の特性を持續し、其後再び黑色の性質に戻ることなかりき。氏は該變異菌は母菌の所屬する黑色線菌科 (Dematiaceae) の特徵を全く消滅したるものにして、これを突然變異と見做さゞる可からざる旨を發表せり。而して Bonar の發表したるものは予等の菌の示せる現象と其變異の狀態、經過共に全く相類似するを以て全然同一現象と見做すことを得可し。氏は此現象を Albino Mutation と記せり。

予等は上述の如く單一胞子による移植の外に菌叢の一部を移植することによりて多數の培養をなし、種々の實驗を試みたれども、其の發育狀態並に色彩は何れの場合にも大差なし。如斯突然變異によりて生じたる菌が菌絲によりて移植さるゝ場合のみならず、胞子によりて移植さるゝ場合にも矢張り其特性を持續するの事實は Bonar(6)の外、Stevens(22), Burger(8) 並に Christensen(9) 等の既に記すところと一致す。 Christensen(9)は亦同一菌中の或生理學的品種 (Physiologic forms) は他の生理學的品種よりも突然變異を生ずること多き傾向ある旨を示せり。此事實を考ふるに或屬又は或科の菌は他の屬又は他の科の菌よりも突然變異を起し易き傾向を有するやも計られざる可く、Stevens, Chrystensen 等が共に *Helminthosporium* 屬の菌に於て、Bonar 及び予等が *Brachysporium* 屬に於て此現象を發見し、而も右兩屬は極めて近緣にして分類學上區別の甚だ困難なるものなることは興味ある點なりと信ず。

次に吾人の得たる白色變異菌は分類學上如何なる位置に隸屬するものなるやを案ずるに、曩に Bonar の報告せる變異菌と正に同一屬のものなるは論を俟たざれども、氏は變異菌の所屬に就き何等論ずるところなかりき。而して予等の所見は Lindau の分類法による Mucedinaceae-Phragmosporae に屬し、Saccardo の Monilliaceae—Hyalophragmiae に屬するものにして、既知の菌屬にて

は *Piricularia, Monacrosporium, Ramularia* 等に最も近似す。

第二章 母菌と變異菌の比較

第一節 形 態

先づ母菌の形態を見るに菌絲は幼若なるものに於ては無色なれども、次第に灰褐色乃至黃褐色に變ず。然れども詳細に之を檢すれば其色に著しき變化あり。Ridgway (18) の標準に從ひ、予等の調査したる結果によれば Buffy Citrine (Ridgway, PL.XVI), Hair Brown (Ridgway, PL.XLVI), Cinnamon Drab (Ridgway, PL.XLVI), Saccardo's Olive (Ridgway, PL.XVI) 等に近きもの多し。隔膜を有し、盛に分岐す。其幅一•八七乃至五•六三μ ありて寄主植物の表面及び內部に蔓延す。擔子梗は絲狀にして直立し、長さ五六乃至四八三μ にして、最も普通なるは一〇〇乃至一五〇μ なり。基部は膨大し、其幅三•七五乃至九•三七μ あり。多くは彎曲し、菌絲と略々同色なれども、先端稍々淡色なることあり。擔子梗は一般に單一なれども僅に分岐するものあり。隔膜數は二乃至三八個なれども八乃至拾壹のもの普通なり(五十個測定の結果)。分生胞子は倒卵形、短棍棒狀、長楕圓形、西洋梨形等諸種の形態を有す。一般には極めて僅に彎曲せる稍々細長なる倒卵形にして一乃至五個の隔膜を有するも、通常は三個の隔膜にして、其部にて極く僅に縊れ、淡褐橄欖色を呈し、兩端の細胞は中央の二細胞よりも著しく淡色なり。而して基部より第三番目の細胞が他よりも稍々長大なるは本菌の特徵なり。長徑一一•二五乃至四二•二五μにして、短徑五•六三乃至一二μ、最も普通なるは長徑二二•五乃至二六•二五μ、短徑七•五乃至九•三七μ なり。

本菌は發芽しつゝある籾種上に黑色天鵞絨狀の菌叢を形成し、非常によく發育するものにして、之に侵されたる根及び子葉鞘等は局部より次第に濃褐色に變ず。予等は本菌を實驗室內に於て發芽しつゝある籾種上に發見したるものにして、未だ天然に於て稻の如何なる部分にも發見したることなし。大正七年六

月出版「稻の病害」と題する著書に於て原攝祐氏(11)は大正六年十月岐阜縣にて稻に一種の *Brachysporium* 屬菌を採集したる旨を記せり。同氏によるに氏の菌は稻の葉、葉鞘及關節附近に煤褐色又は濃茶褐色の不規則なる斑點を形成し漸次葉鞘を取卷き稻は穗を出すことなく枯死し、又籾に該菌の發生せる場合は黑色粉狀を呈すと。予等の母菌は形態に於て原氏の *Brachysporium* 菌に一致す。

次に白色に異變したるものゝ形態を母菌のそれと比較するに菌絲、及び擔子梗の諸性質全く相類似し、唯前者が無色なる點のみを異にす。分生胞子は次表の如く其大さの平均に於て若干の差異なきに非らざるも、最多員數は殆んど同一なりと認め得べく、單に無色なる點が變異菌と母菌との異るところなり。

第一表　母菌と變異菌との形態の比較

			母菌	白色變異菌
乾杏煎汁寒天培養	測定數		551	514
	胞子の長さ(μ)	平均	19.36±0.18	17.82±0.19
		最多員數	19	19
		最大	41	30
		最小	6	4
	胞子の輻(μ)	平均	8.58±0.05	7.89±0.06
		最多員數	8	8
		最大	13	14
		最小	4	4
	隔膜數	平均	2.82±0.03	2.66±0.04
		最多員數	3	3
		最大	4	3
		最小	0	0
アスパ	測定數		524	507
	胞子の長さ	平均	20.43±0.16	19.48±0.23
		最多員數	19	19
		最大	34	34

ラギン加用合成寒天培養	(μ)	最小	6	4
	胞子の幅(μ)	平均	9.52±0.05	9.14±0.07
		最多員數	10	8
		最大	13	15
		最小	4	4
	隔膜數	平均	2.93±0.02	2.56±0.04
		最多員數	3	3
		最大	5	6
		最小	0	0

第二節　培養上の性質

本試驗に當り著者等は容量二五〇c.c.の「エルレンマイエル」氏三角罎に五〇c.c.宛の培養基を注入し殺菌後實驗に供せり。而して各菌に對し一培養基毎に四箇宛の三角罎を使用し豫め乾杏煎汁寒天斜面培養基上に發育せしめたる兩菌の菌叢を白金線を以て各培養基上に移植し、攝氏二十四度內外の定溫室に保ち以て觀察を繼續せり。而して八日後及び十二日後に於ける兩菌の示す菌叢の大さ及發育狀態を示せば第二表及び第三表の如し。尙表中に記せる培養基は次の如き處方に從ひて調製したるものなり。

培養基の處方

一、固體培養基

1　**濃厚醬油寒天培養基**、葱頭煎汁二五c.c.、醬油二〇c.c.、蔗糖五瓦、蒸溜水五〇c.c.、寒天一•七%

2　**稀薄醬油寒天培養基**、葱頭煎汁一〇c.c.、醬油五c.c.、蔗糖五瓦、蒸溜水八五c.c.、寒天一•七%

3　**馬鈴薯煎汁寒天培養基**、馬鈴薯二〇〇瓦、蔗糖二〇瓦、蒸溜水一〇〇〇c.c.、寒天一•七%

4　**稻藁煎汁寒天培養基**、稻藁一〇〇瓦、蒸溜水一〇〇〇c.c.、寒天一•七%

5　**白米培養基**、精白米二〇c.c.、蒸溜水二〇c.c.

6　**玄米培養基**、玄米二〇c.c.、蒸溜水二〇c.c.

7　**乾杏煎汁寒天培養基**、乾杏一五〇瓦、蒸溜水一〇〇〇c.c.、寒天三•五%

8　**玉蜀黍粉煎汁寒天培養基**、玉蜀黍粉二〇瓦、蔗糖五瓦、蒸溜水五〇〇c.c. 寒天一•七%

9　**ペプトン加用合成寒天培養基**、硝酸アンモニア〇•二五瓦、酸性燐酸加里〇•二五瓦、硫酸マグネシウム〇•一瓦、鹽化鐵二%液數滴、ペプトン五瓦、蔗糖一二•五瓦、蒸溜水五〇〇c.c.、寒天一•七%

10　**アスパラギン加用合成寒天培養基**、酸性燐酸加里五瓦、アスパラギン五瓦、鹽化鐵二%液數滴、硫酸マグネシウム二•五瓦、蔗糖五〇瓦、蒸溜水一〇〇〇c.c.、寒天一•七%

二、液體培養基

液體培養基の處方は對照せらる可き前記固體培養基より寒天を除去したるものなるを以て省略す。

第二表　母菌と變異菌との固體培養基上に於ける發育狀態の比較

	母菌		白色變異菌	
培養基の種類	八日後に於ける菌叢の直徑	十二日後に於ける菌叢の色	八日後に於ける菌叢の直徑	十二日後に於ける菌叢の色
濃厚醬油寒天培養基	5 c.m.	*Carbon Gray*(*R's Pl.LIII*)乃至白色	6 c.m.	大部分白色なれども中央部直徑約3.5c.m.は菌叢の下層が *Sea-shell Pink* (*R.'s Pl.XIV*) 色を呈す
稀薄醬油寒天培養基	8 c.m.	*Iron Gray* (*R.'s Pl.LI*), 中央部直徑約 2 c.m. には白色菌叢を散生す	8 c.m.	*White* 乃至 *Light Buff* (*R.'s Pl. XV*)
馬鈴薯煎汁寒天培養基	8 c.m.	*Dark Grayish Olive* (*R.'s Pl.XLVI*)	8 c.m.	大部分 *White* なるも中央部僅かに *Tilleul-Buff* (*R.'s Pl. XL*)を呈す
稻藁煎汁寒天培養基	5 c.m.	*Black*	6 c.m.	*White*
白米培養基	—	*Iron Gray*(*R.'s Pl.LI*)	—	*White*

玄米培養基	—	*Iron Gray*(*R.'s Pl. LI*)	—	*White*
乾杏煎汁寒天培養基	8 c.m.	*Black*	8 c.m.	略々 *White* なるも極めて僅かに *Pale Vinaceous Fawn*(*R.'s Pl. XL*) を呈す
玉蜀黍粉煎汁寒天培養基	8 c.m.	*Deep Grayish Olive*(*R.'s Pl. XLVI*)	8 c.m.	*White*
ペプトン加用合成寒天培養基	7 c.m.	*Iron Gray*(*R.'s Pl. LI*)なれども中央部僅かに白色、培養基を *Terra Cotta* (*R.'s Pl. XXVIII*)に變色せしむ	7 c.m.	最下位 *Pale Ochraceous-Buff*(*R.'s Pl. XV*)なるも表面 *White* なり母菌と同樣培養基を變色せしむ
アスパラギン加用合成寒天培養基	6 c.m.	*Deep Olive Buff*(*R.'s Pl. XL*)なるも緣部は *Dark Ivy Green*(*R.'s Pl. XVIII*)なり。培養基を *Terra Cotta* (*R.'s Pl. XXVIII*)に變色せしむ	6 c.m.	*White* 乃至 *Light Pinkish Cinnamon*(*R.'s Pl. XXIX*)。培養基を *Terra Cotta* (*R.'s Pl. XXVIII*)に變色しむ

第三表　母菌と變異菌との液體培養基上に於ける發育狀態の比較

	母菌		白色變異菌	
培養基の種類	十二日後に於ける菌叢發育程度	十二日後に於ける菌叢の色	十二日後に於ける菌叢發育程度	十二日後に於ける菌叢の色
濃厚醬油培養液	++	氣中菌絲白色なるも液に浸れる菌絲は *Vinaceous-Fawn* (*R.'s Pl. XL*)なり	++	母菌と同じ
稀薄醬油培養液	++	*Iron gray*(*R.'s Pl. LI*)	++	*White*
馬鈴薯煎汁培養液	++	*Iron gray*(*R.'s Pl. LI*)	++	僅かに發生せし氣中菌絲白色なるも、液中に沈下せしものは殆んど無色なり
稻藁煎汁培養液	+	*Black*	+	*White*
乾杏煎汁培養液	++	*Black*	++	*White*
ペプトン加用合成培養液	+++	*Iron gray*(*R.'s Pl. LI*)なるも、僅かに白色を呈する部あり。液を *Terra Cotta*(*R.'s Pl. XXVIII*)に變色せしむ	+++	大部分白色なるも *Light Pinkish Cinnamon*(*R.'s Pl. XXIX*)を呈する部あり。母菌と同樣に液を變色せしむ
アスパラギン加用合成培養液	+	略々 *White* なるも諸所に黑色部を生ず	+	*White*

前表に示せし如く濃厚醬油寒天培養基、同培養液、及びアスパラギン加用合成培養液に發育せしものは母菌も亦殆んど白色を呈し、一見變異菌と區別し難

しと雖、他の培養基上にありては一般に母菌は明かに黒色に近く着色するも白色變異菌は依然として白色の菌叢を生ず。斯の如く變異菌と母菌は明かに共の菌叢の色を異にするも發育狀態には大なる差異を示さゞりき。

第三節　發育に及ぼす温度の影響

培養基上に於ける植物病原菌の發育と温度との關係を明かにするは植物病理學上並に治病學上の諸種の問題に關聯し重大なる意義を有するものにして、突然變異によりて生じたる予等の新菌が母系の菌に比較し斯の如き生理學的性質にも變化を受けたるや否やを明かにするは極めて興味ある事柄なり。故に予等は母菌と突然變異菌とを三種の異なる培養基に移植し、同時に六種の異なる温度に於て發育狀態を比較せり。

實驗方法 本實驗に使用したる培養基は乾杏煎汁寒天培養基、アスパラギン加用合成寒天培養基及び稀薄醬油寒天培養基にして、前章にて記述したるところと同一處方によりて調製せり。豫め試驗管に約十五c.c.宛入れて殺菌し、別に用意したる殺菌ペトリ皿に試驗管一本宛を溶解注入し、凝結するを待ち、豫め純粋培養せる各菌菌叢の一部を共の中央に移植し、直ちに所要温度に調節したる定温器又は定温室に入れ檢査時以外は全く暗黒に保てり。而して最低實驗温度(攝氏拾度內外)の場合のみは室温にて暗黒に保ち、自記寒暖計にて培養中の温度を測定したるものなり。同一温度に對し同一培養基を五個宛とし發育せる菌の聚落の直徑を測定し共平均を比較することゝせり。

實驗結果 室温を除き各温度共に移植後一晝夜にして僅かに菌絲の發育せるを認めたれども、室温のものにありては二晝夜後初めて共の發育を認め得たり。各培養基による實驗結果次の如し。但し數字は聚落の直徑を糎にて示したるものにして、大體に於てペトリ皿五個宛の平均なれども、第一回實驗に在ては三二度、二八度並に二四度等に於て不純物の混入せしものありて、豫定數の平均を示す能はざりしものあり。加之夫等の温度は本菌發育に對する最適温度に最も近きものなるを以て、本實驗の如き簡易なる方法によりては假令五個の平均

なりとも正確なる比較をなし能はざるものなるを知れり。

第一回實驗成績(大正十四年十二月十二日)

第四表 乾杏煎汁寒天培養基上に於ける兩菌々絲の發育と温度との關係

菌系	母菌				突然變異菌			
發育期間 / 温度(C)	二日目	四日目	六日目	八日目	二日目	四日目	六日目	八日目
±32°	1.80	3.50	5.00	5.75	1.20	3.30	4.30	5.24
±28°	2.00	4.50	6.00	6.50	2.00	4.50	6.00	7.50
±24°	1.20	2.80	4.50	5.60	1.40	3.50	5.00	6.00
±20°	1.00	2.60	4.00	5.20	1.10	2.80	4.00	5.20
±16°	0.70	2.00	3.10	4.16	0.70	2.00	3.00	3.92
±10°	±	0.80	1.50	1.94	±	0.80	1.30	1.60

第五表 アスパラギン加用合成寒天培養基上に於ける兩菌々絲の發育と温度との關係

菌系	母菌				突然變異菌			
發育期間 / 温度(C)	二日目	四日目	六日目	八日目	二日目	四日目	六日目	八日目
±32°	1.30	2.60	4.00	4.69	1.20	2.40	3.50	3.75
±28°	1.10	2.30	3.40	4.20	1.40	2.80	3.80	4.40
±24°	1.00	1.70	2.50	3.10	1.30	2.00	2.50	3.56
±20°	0.70	1.60	2.30	3.00	1.00	1.60	2.30	3.00
±16°	0.60	1.30	1.80	2.32	0.80	1.60	2.40	2.72
±10°	±	0.70	1.20	1.48	±	0.90	1.00	1.52

第六表　稀薄醬油寒天培養基上に於ける兩菌々絲の發育と溫度との關係

菌系	母菌				突然變異菌			
發育期間 / 溫度(C)	二日目	四日目	六日目	八日目	二日目	四日目	六日目	八日目
±32°	2.00	5.00	7.00	7.67	1.90	5.00	7.00	7.56
±28°	1.90	4.50	6.50	7.40	2.00	4.50	7.00	8.00
±24°	1.20	3.80	5.30	6.40	1.20	3.50	5.00	6.26
±20°	1.00	3.00	4.50	5.30	1.00	2.70	4.30	5.12
±16°	0.90	2.30	3.50	4.16	0.50	2.00	3.20	4.04
±10°	±	0.50	1.50	1.76	±	0.50	1.20	1.72

第二回實驗成績（變異菌は大正十五年五月十三日 母菌は大正十五年五月十四日施行）

第七表　乾杏煎汁寒天培養基上に於ける兩菌々絲の發育と溫度との關係

菌系	母菌				突然變異菌			
發育期間 / 溫度(C)	二日目	四日目	六日目	八日目	二日目	四日目	六日目	八日目
32°—33°	1.88	3.36	4.06	4.80	1.40	3.32	4.20	5.06
±28°	1.82	3.78	5.18	6.02	1.52	3.76	4.48	5.40
24°—25°	1.58	3.62	5.14	6.34	1.26	3.36	4.66	5.68
±20°	1.02	2.34	3.94	5.12	0.74	2.16	3.36	4.46
±16°	0.62	1.50	2.92	3.95	0.54	1.46	2.64	3.68
10°—15°	—	0.76	1.62	2.48	—	0.64	1.38	2.14

第八表　アスパラギン加用合成寒天培養基上に於ける兩菌々絲の發育と温度との關係

菌系	母			菌	突然變異菌			
發育期間／温度(C)	二日目	四日目	六日目	八日目	二日目	四日目	六日目	八日目
32°—33°	1.15	1.70	2.66	3.40	0.98	1.85	2.45	3.38
±28°	1.22	1.92	3.18	4.48	0.92	1.96	3 02	4.10
24°—25°	1.30	2.26	3.00	4.18	1.04	1.92	3.00	3.86
±20°	0.82	1.56	2.40	3.48	0.66	1.40	2.00	2.92
±16°	0.62	1.16	2.04	2.82	0.50	1.08	1.78	2.32
10°—15°	—	0.96	1.70	2.46	—	0.70	1.14	1.50

第九表　稀薄醬油寒天培養基上に於ける兩菌々絲の發育と温度との關係

菌系	母			菌	突然變異菌			
發育期間／温度(C)	二日目	四日目	六日目	八日目	二日目	四日目	六日目	八日目
32°—33°	2.54	4.72	5.98	7.10	2.15	4.68	6.28	7.37
±28°	2.63	4.61	6.55	7.52	2.20	4 46	5.65	7.03
24°—25°	2.00	4.28	5.96	6.86	1.76	3.38	4.40	5.24
±20°	1.28	2.66	4.28	5.70	0.95	2.30	3.54	4.75
±16°	0.10	0.21	3.48	4.80	0.72	1.78	2.98	4.00
10°—15°	—	1.00	2.02	3.03	—	0.60	1.08	1.40

前表に於て明かなる如く第一回の實驗に於ける乾杏煎汁寒天培養基上に於て

は兩菌共攝氏二八度前後に於て最大の聚落を生じ、アスパラギン加用合成寒天培養基上に於ては母菌は三二度に於て變異菌は二八度に於て最大の聚落を生じたるも、其の數字上の差異大ならず。稀薄醬油寒天培養基上に於ては反對に母菌は三二度、變異菌は二八度が最大の聚落を生ぜり。然れども前培養基上に於けると同樣に其の數字上の差異僅少なるのみならず、個々のペトリ皿に就きて比較するに何れが適温に近きかを容易に斷定し難き場合多し。而して第二回實驗に於ては、乾杏煎汁寒天培養基上に於て意外にも兩菌共二四度乃至二五度に於て最大の聚落を形成し、アスパラギン加用合成寒天培養基上に於ては母菌、變異菌共に二八度に於て最大の聚落を生ぜり。稀薄醬油寒天培養基上に於ては第一回實驗成績と正反對に母菌は二八度、變異菌は三二—三三度を以て夫々最大の聚落を形成せり。然れども數字上の相違は何れの場合と雖、極めて僅少なりき。著者等は本實驗に當り發育の程度を聚落の直徑のみを以て比較したれども、菌絲の發育量は聚落の直徑のみにて代表せしめらるゝものに非ず。氣中菌絲の量、基中菌絲の量、菌叢の厚さ等をも充分考慮せざる可らざるは論を俟たざる處なり。從て如上の成績不一致の原因奈邊に存するかを略想像し得るが如し。

以上記せし如く第一回實驗成績と第二回實驗成績とを比較するに母菌及變異菌ノ温度に對する關係は假令同一ならずとするも、其の差異决して大なるものに非らざるが如し。而して菌絲の發育に對する最高温度は共に攝氏三十二度より遙に高く、最適温度は攝氏二十八度前後、最低温度は攝氏十度よりも幾分低き度にあるが如し。

第四節　稻苗に對する病原性

突然變異によりて生じたる新菌の稻苗に對する病原性が母菌に比較して如何なる差異を示すかを知るは極めて重要なる問題なり。仍て予等は右の關係を明にせんがため、予等(13)の常用せる方法に從ひ「エルレンマイエル」氏三角罎に無菌培養せる稻苗に大正十五年二月八日並に二月十八日の二回接種試驗を施行りせ。母菌が病原性を有することは著者等の施行したる幾多の實驗に據りて證

明せられたれども、其の實驗の詳細に亘りては他の論文に於て記することゝす。而して本論文に於ては單に母菌と變異菌との病原性の强弱を比較したる業績のみを記すことゝす。即ち脫稃せる種子を二千倍昇汞アルコールにて十分消毒し、殺菌水にて充分洗滌後殺金白金線を以て、Sachs氏液寒天培養基を含める三角罎の中央に四粒宛播種し四日間攝氏二十三度前後の定溫室に入れて發芽せしめ、次で硝子室に移し、被害狀態を觀察せり。但し菌は播種と同時に移植せり。本實驗に於て脫稃したる種子のみを使用したるは消毒並に播種の煩を省略し得ることゝ、斯の如くせば一般に强き病原性を示すを以てなり、即ち脫稃したる種子は消毒に便にして著者等の經驗によれば曩に發表したる方法(13)によりて馬鈴薯寒天培養基に蒔き定溫器に放置するも細菌其の他の微生物の發生を見ること極めて稀なるを以て、本實驗に於ても亦供試菌以外のものゝ隨伴すること殆んど無きものと見做し大過なきを信ず。表中葉長とせるは一株中最長のものゝ測定にして根長とせるは一株の有する總ての根の根長の總和なり。

第十表　第一回接種試驗結果

二月八日接種、三月十二日調查　　　供試稻品種關取

菌系	母菌（三十二株平均）	突然變異菌（二十七株平均）	無接種（二十七株平均）
葉長(糎)	3.08	2.80	13.41
根數	0.96	0.93	6.00
根長(糎)	1.60	1.60	29.23

備考　本實驗に於て病原菌のために全然枯死したるものが母菌によつて九本(28.1%)突然變異菌によつて八本(29.6%)あり。夫等のものの內には全然根の發育を示さゞるものあり。

第十一表　第二回接種試驗結果

二月十八日接種、三月十二日調查　　　供試品種　日出撰

菌系	母菌（四十二株平均）	突然變異菌（四十七株平均）	無接種（四十五株平均）
葉長(糎)	8.56	9.78	12.10
根數	3.83	4.43	7.60
根長(糎)	12.03	16.11	40.90

備考　本實驗に於て全然枯死したるものは突然變異菌を接種したるものに於て一本を見たるに過ぎず。

以上の二實驗結果によりて見るに予等の菌は突然變異によりて病原性に何等の影響をも受けざりしが如し。

Stevens(22) は *Helminthosporium* 屬菌に於て得たる多くの突然變異體につき小麥其の他の禾穀類に對する病原性を試驗し、各變異體の間に病原性に關する著しき差異を認むる能はざりしを以て *Helminthosporium* 屬の菌類が多くの異る禾穀類を侵し得るは寧ろ此の屬の通性にして病原性に於ける小異を論議するの無意義なる旨を指摘せり。Christensen(9) は最近 *Helminthosporium sativum* P.K. et B. の粹純培養に於て多數の突然變異體を得、母菌と十三系の變異菌との間に生ぜる大麥及び小麥に對する病原性の差異の有無を試驗せり。久等の變異菌は何れも同一程度の病原性を有せず、彼等の多くは母菌に類似の病原性を示したれども、二系の變異菌は母菌よりも遙かに強き病原性を有し、三系の變異菌は母菌よりも弱き病原性を有する旨を發表せり。

次に母菌並に白色變異菌が稻苗(品種關取)を侵したる場合の病狀を見るに兩菌共に發芽後間もなく根を侵してこれを褐色に變ぜしめ、漸次病勢は莖の基部に進み其部を同樣に褐色に變ぜしむ。根は病勢の進展と共に次第に濃褐色に變じ遂に發育を停止するに到る。其の後籾上に母菌は黑色天鵞絨狀の菌叢を形成し、多數の分生胞子を生ずるも、白色變異菌にありては白色乃至 Pale Vinaceous—Fawn (R.'s Pl. XL) の菌叢を生じ、菌叢の表面は分生胞子形成のため白き粉狀を呈せり。

第三章　變異菌々叢の着色と培養條件との關係

微生物が基上に培養せらるゝに當り、環境の變化によりて菌の性質に多少の變異を示すことあるは明かなるところにして、時には恰も別種の如き觀を呈することあり。斯くの如き變異は只一時的にして其の性質を次代に傳ふることな

し。故に突然變異によりて黑色の性質を消失し白色を呈せる著者等の菌が全然菌叢の色に變化を呈せざるものなりや否やを明かにするは興味ある處なるのみならず、何等かの處置によりて母菌の性質に復歸すること無きや否やを知ることも亦重要なりと思惟し、次の如き觀察及び實驗を試みたり。

其一　明處に於ける培養

今大正十五年二月二十八日アスパラギン加用合成寒天及び稀薄醬油寒天培養基に白色變異菌を移植し、三月二十八日迄一ケ月間光線の射入充分なる溫室の棚上に並列したるに、前者に於ける菌叢は白色乃至 Pale Cinnamon Pink (R.'s PL.XXIX) を呈し、後者に培養せる菌叢は純白色を呈し、共に母菌の菌叢に類似の色彩卽ち帶綠黑色乃至橄欖色に近き色彩を全然表はさゞりき。然るに同月同日アスパラギン加用合成寒天培養基に平面培養したるものを溫室よりは溫度の高低更に甚だしきも光線の射入前同樣充分なる硝子室内の棚上に並列し置きたるに三月二十八日迄の間に菌叢の色が同心圓的に數層淡綠色を帶べるを認めたり。尙二月八日並に二月十八日の二回溫室內にて發芽後間もなき稻に接種し菌叢發育の狀態を觀察したるに共に白色にして何等の變化をも示さゞりき。

其二　菌叢の色の變異に及ぼす培養溫度の影響

アスパラギン加用合成寒天培養基に培養したる白色變異菌は攝氏二十四度及び攝氏二十八度の定溫器中に於て永く白色を變ぜざれども、攝氏三十二——三十三度の定溫器中に於ては菌叢の大部分は白色なるも、中央に近く Vinaceous Buff(R.'s PL. XL)の氣中菌絲を生ぜり。斯の如きものを檢鏡するに菌絲及厚膜胞子樣の細胞が如上の如き着色を示せるを見る。斯く變色したる部分の菌絲及び分生胞子を取りて他の培養基に移植する時は、再び明かに白色菌叢を生じ、該變色を次代に傳へざるを知れり。

然るに同一培養基に三月三日に移植したるものを攝氏二〇度及び一六度の低溫にて發育せしめたるものは三月二十八日に檢したるに白色の菌叢の表面大部分 Pale Smoke Green 乃至 Smoke Gray(R.'s PL. XLVI)に變色せり。此變色

は稍々母菌の色に近き色彩を帶びたるものと言はざるべからず。然れども此着色部より移植したる新培養は依然として白色の菌叢を生じたるを以て如上の着色は彷徨變異に過ぎざるを知る可し。

其三　菌叢の色の變異に及ぼす急激なる培養温度の低下と光線の影響

實驗第一

白色變異菌をアスパラギン加用合成寒天培養基に平面培養し、攝氏一六度、二〇度、二四度、二八度、三二度にて八日間定温器内にて生育せしめたる後、攝氏一〇度前後の室内明所に移したるに(午前)、三二度、二八度のもの及び二四度の或るものは翌朝迄に菌叢の緣部に當り約四粍の巾にて輪狀に灰綠色を呈せり。斯の如き着色部を檢鏡するに菌絲、擔子梗、分生胞子共に淡橄欖色を帶べり。この變色は恰も母菌の性質に戻れる傾向の如く思惟せらるゝも、變色せる菌叢を他の培養基に移植し、攝氏二八度に培養するときは其の性質を次代に傳ふることなく、再び白色の發育をなせり、然らばこの彷徨變異は如何なる環境の影響によりて起りたるやを案ずるに、温度の急激なる變化によるか又は暗所より明所に移したる結果なるかの何れかならざる可からず。仍て此點を明にせんがため更に實驗を繼續せり。

實驗第二

大正十五年二月及三月中に白色變異菌のペトリ皿内寒天平面培養を造り、先づ攝氏三十二度前後に保てる定温器にて發育せしめ、四日目、五日目、八日目一〇日目に攝氏十度内外の室内明所に移し一部のものは、ブレキ罐又は黑紙にて被覆して暗黑に保ちたり。斯の如き處置をなせるものは多くは一晝夜中に菌叢の一部が約半糎の巾に輪狀に灰綠色を帶ぶるに至れり。其變色程度は實驗毎に多少の差異あるも Glaucous (R.'s PL. XLI), Grape Green(R.'s PL XLI) に近き色にして最も濃厚なる部分は Lincoln Green (R.'s PL.XLI) を呈せり。今各實驗結果を示せば次表の如し。

第十二表　温度の急變と菌叢着色との關係

實驗番號	培養基種類	高温に培養せる日數	低温に曝露中の狀態	着色の有無
一	アスパラギン加用合成寒天培養基	四	明處	−
二	乾杏煎汁寒天培養基	四	明處	+
三	乾杏煎汁寒天培養基	五	明處	+
四	乾杏煎汁寒天培養基	五	ブレキ罐にて被覆	+
五	乾杏煎汁寒天培養基	八	明處	+
六	アスパラギン加用合成寒天培養基	一〇	明處	+
七	乾杏煎汁寒天培養基	五	明處	+
八	乾杏煎汁寒天培養基	五	實驗中黑紙にて包む	+
九	アスパラギン加用合成寒天培養基	一〇	明處	+
十	アスパラギン加用合成寒天培養基	九	明處	+
十一	稀薄醬油寒天培養基	八	明處	+

以上の如く實驗一を除き他は悉く着色したれども實驗四のものは實驗三のものに比し、實驗八のものは實驗七のものに比し着色程度稍々劣るを認めたり。實驗九は實驗六と同一の試驗を繰返したるものにして同樣の結果を得たり。而して着色部を取りて顯微鏡檢査を行ふに菌絲も分生胞子も共に淡く着色せるを認む。實驗五、及び實驗九に於ては着色菌叢の一部を他の培養基に移植し何れも再び白色菌叢のみの發育するを認めたり。

實驗第三

本實驗に於てはアスパラギン加用合成寒天培養基に平面培養したるものを攝氏三十二度前後の定温器中に十日間保ちたる後、半數は攝氏九乃至一〇度前後の室内明處に移し、半數は氷を以て攝氏一度乃至六度に冷却したるに翌朝に至

り前者は着色したるも後者は着色せざりき。

實驗第四

アスパラギン加用合成寒天培養基に平面培養し、十一日間攝氏三十二度前後の定溫器に保ちたるものを午前九時に室內明處に移したるに、同日午後六時菌叢の一部に業に輪狀に淡綠色を表はし、翌朝に至れば更に着色濃厚となり、Lincoln Green(R.'s PL.XLI) に變ずるを見たり。この着色せる部分より着色せる八ケの單一胞子を分離し、他の培養基に移植したるに何れも白色の菌叢を生じ、着色を次代に傳へざりき。

實驗第五

アスパラギン加用合成寒天培養基に平面培養せるものを一部は移植直後に錫箔二枚にて包み、更に其の上を厚き黑紙二枚にて包み、攝氏三十二度前後の定溫器中に十日間保ちたる後、室內明處(最高十四度)に移したるに、最初より少しも包まざりしものは翌朝迄に着色し、最初錫箔等にて包み溫度の低下と共に開封したるものは唯一皿のみ着色し、他は變化なく、溫度低下後も包みたる儘のものは全部着色せざりき。

實驗第六

アスパラギン加用合成寒天培養基に平面培養したるものを拾日間攝氏二十四度、二十八度及び三十二度前後の定溫器に保ちたる後室內明處に移したるに、翌朝に至り三十二度前後のものは最も濃く着色し、二十八度のものは稍々着色し二十四度のものは全く着色せざりき。同時に同溫度に培養したるものを溫室內明處(最高三十三度最低十六度半)に移したるに三十三度のものも二十八度のものも極めて僅かに着色したるに過ぎず。二十四度のものは全然着色せざりき。

實驗第七

乾杏煎汁寒天培養基に平面培養したるものを移植後直ちに錫箔二枚にて密封し、其の上を更に厚き黑紙二枚にて包み絕對に光線を遮斷し攝氏三十二度前後に五日間保ち、後是等を室內明處に移したるに直ちに開封せるものは翌朝に至

り中央部に着色を示したり。室内に移したる後四日間密封の儘單に溫度の急變に接せしめたるものも四日後開封したるに菌叢の中央部が僅に着色を示せり。

以上の實驗結果を通覽するに着色の程度は顯著ならざる場合多しと雖、菌叢が環境の急變によりて綠色に近き色彩を呈することは極めて普通の現象と見做さゞる可からず。而して如上の實驗より、それが光線の影響なるか、溫度の影響なるかを斷定するは尙早計に似たれども明暗兩所に於て同溫度に保ちたる場合、前者が後者よりも濃厚に着色せる事實より推察すれば光線も亦直接或は間接に多少關係を有するものの如く思惟せらるれども、實驗第七の如きは前者と多少異る關係を示したるを以て、着色は溫度の激變に基因するものゝ如くにも考へらる。此點に就きては今後復雜なる生物化學的考察に俟たざれば斷定し得ざれども、先づ光線及び溫度の兩者が共に着色と直接或は間接に關係を有するものと見做す可きならんか。

總　　括

一、絲狀菌が培養基上に於て體細胞突然變異即ち無性的突然變異を起すことあるは輓近の研究によりて學界に報告されたるもの多く、其の研究は漸く病理學的にも重大視さるゝに至れり。著者等は其著例と思はるゝ一例に接し爾來變異菌の性狀に關し研究するところありしを以て本論文に於て其結果を報告することゝせり。

二、母菌は籾種の發芽を害し、又は稻苗の生育を阻害する菌にして、分類學上黑色線菌科(Dematiaceae)に隸屬し、*Helminthosporium* 屬に極めて近緣のものなれども、著者等は寧ろ *Brachysporium* 屬に入るゝを至當なりと信ず。然れども其種名に就きては尙今後の研究を俟たざれば決定し得ず。

三、予等の得たる突然變異菌は形態的には全く母菌に等しく、唯單に母菌の有する黑色の性質を全然消失したる點を異にす。

四、各種の培養基上に生じたる突然變異菌の菌叢は殆んど白色にして、母菌の

夫とは著しく異なるも、菌叢發育の狀態は殆んど母菌と大差なし。

五、突然變異菌の發育に及ぼす溫度の影響は母菌に對する影響と小異を示したるに過ぎず。

六、著者等の得たる突然變異菌は稻苗に對し母菌と殆んど同一程度の病原性を示せり。

七、突然變異菌を高溫(攝氏三十二度前後)及び低溫(攝氏一六度及び二十度)にてアスパラギン加用合成寒天培養基上に發育せしむるときは僅かに着色するものあれども其の變色を次代に傳ふることなし。

八、高溫暗所に保ちたる突然變異菌の平面培養を急激に低溫なる室內明處に並列するときは、白色菌叢上に多少着色するものなれども、此變色も亦次代に傳ふることなし。

終に蓝み本研究の一部は文部省自然科學研究奬勵費の補助によりて行ひたることを附記し、文部省並に研究中援助せられたる諸氏に深厚なる謝意を表す。

(大正十五年八月二十日稿。京都帝國大學農學部植物病理學研究室に於て)

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圖版の說明

Fig. 1 母菌の發育と溫度との關係

A……10°—15°C., B……±16°C.,
C……±20°C., D…24°—25°C.,
E……±28°C., F…32°—33°C.

Fig. 2 變異菌の發育と溫度との關係

A……10°—15°C., B……±16°C.,
C……±20°C., D…24°—25°C.,
E……±28°C., F…32°—33°C.

Fig. 3 { A…母菌に侵されたる稻苗
B…白色變異菌に侵されたる稻苗 }

Fig. 4 {培養條件の急變によりて生じたる白色變異菌の菌叢の着色を示す}

Fig. 5 母菌の分生胞子(擴大)

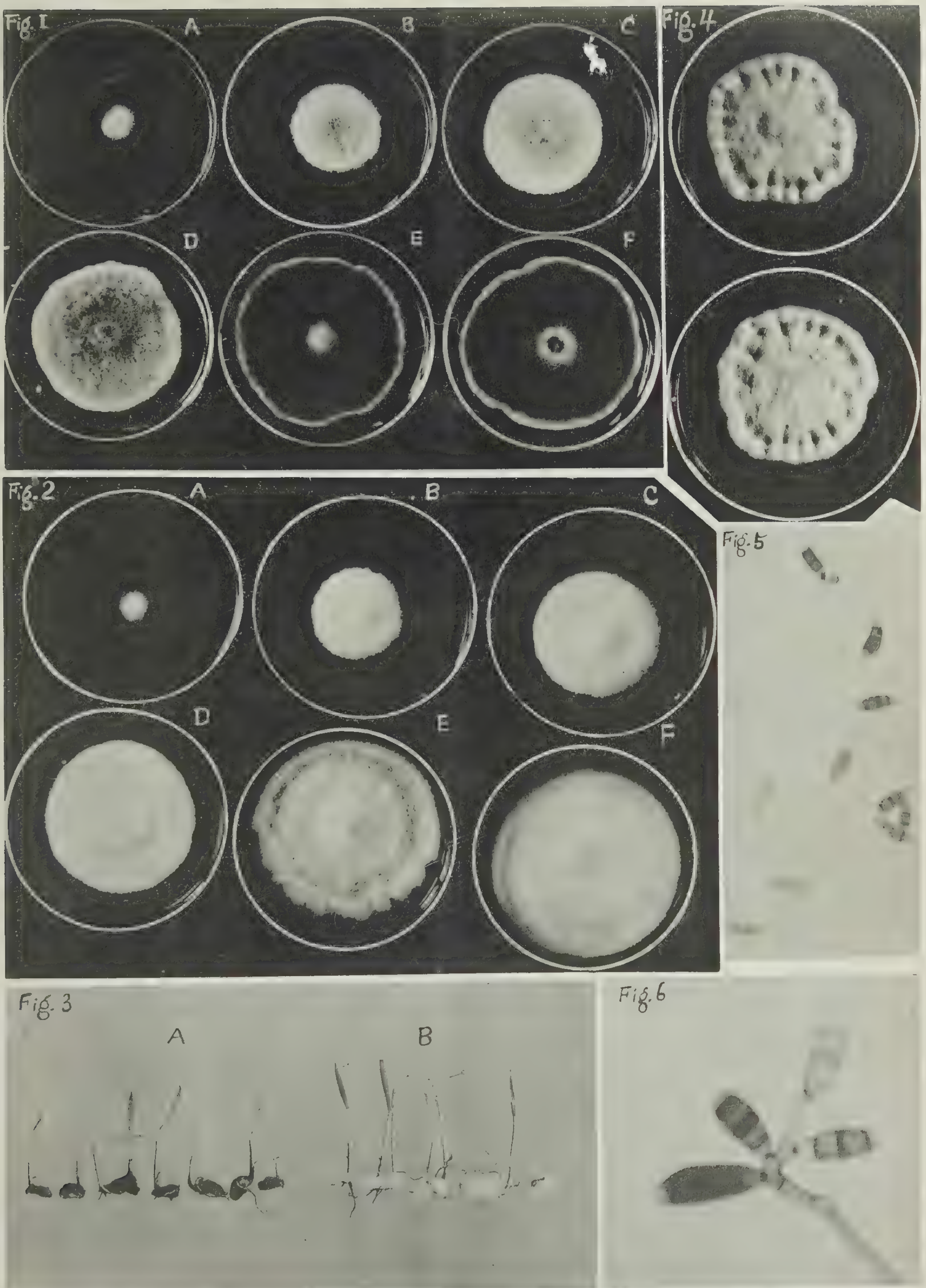
Fig. 6 {母菌の分生胞子と擔子梗(擴大)}

Resuém

Recent publications indicate that asexual mutations in fungi occur frequently

on culture media. In the present paper a distinct albino mutation by a species of *Brachysporium* parasitic on the rice-seedlings is reported. *Brachysporium* is a genus of *Dematiaceae*, and is characterized by dark brown mycelium and conidia. The parental form under consideration was isolated from an infected seedling of the rice plant in April, 1925. Cultures were started from single spores at that time. In October of the same year we found that from the lower portion of the slant of the apricot-decoction agar in a test tube, a sector grew out which lacked the usual color character. Subcultures were made from the contrasting area of this culture, by transferring some of the white mycelium to other culture media. The conidia produced by this albino strain correspond substantially in size and shape with those of the normal strain.

Repeated single-spore isolations have been made, and these cultures remain all constant for the character of albinism, as do the cultures made by isolating bits of mycelium. Effect of temperature on the growth of the mutant and also of the parental form has been studied. But we could not find any remarkable difference between them. The optimum temperature for the growth of them seems to lie at about 28° C. In order to ascertain whether there are any differences in degree of virulence of the mutant and its parent, comparative inoculation experiments were made on the rice seedlings. The results obtain d indicate however that they have almost the same degree of virulence. In the present paper the results of our investigations on the effect of some environmental factors to the color modifications of the albino strain on the cultures are also described.



Matsuura et Matsuo phot.

欵冬の細菌性斑點病

瀧 元 清 透

Bacterial disease of Petasites.

Seito Takimoto

In July, 1921, the bacterial disease of Petasites (Petasites Japonicus Miq.) was first observed by the writer in the vicinity of Fukuoka. In March 1922, the same disease was observed at Dazaifu, and also in the farm of Fukuoka Agric. Exp. Station, near Fukuoka. In November 1923, the writer collected the diseased leaves of petasites in the farm of Kagosima Agric. Exp. Station, near Kagosima.

With these material numerous isolations were attempted, and the blackened areas of the lesions were found to contain the bacteria in large number and no fungi. Inoculations proved that the disease is caused by a bacterium hitherto undescribed. Therefore the brief descriptions are mentioned as follows:

Symptom : In the early stages the disease appears on the leaves as small circular brown spot, the spots gradually become enlarged and irregularly elongated. Sometimes the spots turn black and finally look like rag. On the under surface of the leaves, the spots at first take on dull green or dark purplish brown, and then usually turn dark brown.

Blackened area are cut into small pieces which are dipped in 80% of alcohol for few seconds. The piece then are put in mercuric chloride solution 1 : 1000 for 1—2 minutes, rinsed in sterile water, and transferred in bouillon from which the dilution plate cultures are made. Successful isolation is also made from d seased pieces free from contamination with flamed knife instead of disinfectation as above.

Inoculation experiments : Three methods were applied such as injection, smearing and spraying. The water suspension of the organism from one day old agar cultures was used as inoculum. In the case of injection and smearing the lesions appeared in 1 or 2 days but when spraying was applied they appeared in 5 days taking the characteristic symptoms. The upper side of the leaves is more susceptible to the disease than the under. By these inoculation experinents

the pathogenicity of the organism was confirmed, and the organism was found to infect the plant without wounds.

Morphological characters of the organism: The organism is a short rod with rounded ends, and motile by means of a polar flagellum. It occurs singly or occasionally in pairs. The limit of size is 1.1—1.7 x 0.8—1.0 μ. No spore have been observed even in one year old cultures. Capsule and involution forms are not formed. It stains readily in basic anilin dyes. Gram's stain gives negative result.

Cultural and biochemical characters of the organism: (All cultural tests were made at 28° C., with exception of gelatin culture.)

Agar plates (+15° in Fulles's scale): The surface colonies are circular or amoeboid flat with smooth and entire margine, and their color are pale whitish at first and finally dirty whitish taking granular structure.

Agar slant: In newly isolated cultures growth is filiform but when repeatedly transferred it becomes spreading. The surface is smooth of slightly verrucose and the consistency is butyrous.

Bouillon: Strong clouding occurs in 24 hrs., fine powdery pellicle and heavy viscid precipitation are formed in one or two months. The reaction of medium when titrated with phenolphthalein is +0 to —5 while that of control is +15.

Potato plate: Vigorous growth occurs in 24 hrs., the surface of the colonies is flat and verrucose; conspecuous odor is emitted; starch destroyed feebly; color of the growth is marqurite yellow.

Litmus whey: At first litmus begins to turn blue, then the bleaching occurs at the bottom of the tube, and in 30 days the milk coagulates; in 3 weeks the bleaching is complete except 1 c.m. of the upper parts of the tubes.

Uschinsky's solution: Uniform clouding occurs, but rather feeble, in 10 days powdery white pellicle and the heavy viscid sediments are formed.

Fermentation tube tests: (1) In potato juice moderate clouding occurs in the open and clossed ends of the tubes, and the abundant gas is produced. The fluid in the open arms turns, brownish black, and its reaction becomes alkaline, (2) in 2 % of Teruuchi's peptone water containing 2 per cent of dextrose, sucrose, lactose, mannit respectively, strong clouding occurs in both arm

in 2 days and then gas and heavy precipitation are produced. The reaction of the fluid is alkaline, (3) in 2 % of Teruuchi's peptone water containing 3 per cent glycerine clouding occurs strongly in the open arm and slowly and feebly in the clossed. The heavy precipitation is formed without gas and the reaction of the fluid become acid.

Aerobism : The organism grows in Buchner' s tube, and also in the clossed end of the tubes containing sucrose, dextrose or mannit.

Hydrogen sulfide : Hydrogen sulfide is not productd, the lead acetate paper suspended over the broth culture being not blackened.

Nitrite in nitrate bouillon : Nitrates is reduced in 3 days.

Temperature relation : The maximum temperature for growth on beef broth is about 47°C., at 5°C. the organism does not grow even in the course of 6 days, the optimum temperature for growth is 27—30° C., the thermal death point ranges between 55°C. and 56°C.

Moisture relation : The organism stands to dryness. The organisms from 3 days old broth cultures were smeared on the cover glasses and placed in sterile Petri-dishes which had been kept in desiccator. When each piece of these cover glasses was thrown into sterile bouillon at definite intervals there was a good growth in that of 9 days keeping, but none in that of 11 days keeping.

Torelation of acids : There is a feeble growth in beef broth (originally +15) containing 0.1 % and 0.2 % of citric or tartaric acid, but none in that of 0.3 % of the acids.

Torelation of natrium chloride : There was a feeble growth in beef broth containing 6 % of natriun chloride, but none in that of 8 or 9 %.

Effect of sunlight : The organism is not sensitive to bright sunlight. In 2 hours exposure one-third of the bacteria were destroyed, and in 3 hrs. exposure all were destroyed.

Vitality on culture media : It remained alive for 11 months on beef agar.

Technical description :

Bacterium Petasitis n. sp.

Short, rapidly growing rod with rounded ends, motile by means of a polar flagellum, occurring single or in pairs ; average measurements 1.1—1.7 x 0.8—1.0

μ. ; no spore, capsule, zoogloea nor involution form observed ; Gram negative ; stains readily in gentian violet and methylen blue ; facultative aerobic. Colonies on beef agar white, circular or amoeboid, flat, with entire margins ; smooth surface and butyrous consistency ; gelatine not liquefied ; milk curdled in 30 days ; litmus whey reduced ; indol not produced ; gas formed ; nitrates reduced ; slight diastasic action on potato plate ; good growth in Uschinsky's solution ; Max. Temp. for growth 47°C. ; opt. temp. 27—30°C. ; thermal death point 55—56°C.; it not sensitive to dryness, destroyed in 3 hrs. exposure to bright sunlight ; long vitality on culture media. Pathogenic on the leaf of Petasites Japonicus Miq. in Fukuoka and Kagosima prefectures.

摘　要

(一) 一九二一年以後福岡縣地方の欵冬に一種の細菌性の病害發生し、葉を枯損し被害大なりき。

(二) 本病は最初葉面に小なる褐色の圓形病斑を生じ漸次增大且不規則的に延長し遂に襤褸狀となりて枯損す。

(三) 數回に亘り細菌の分離及接種を行ひたるに常に白色の細菌を分離し、該細菌は無傷の葉面に感染し得るものなることを知れり。

(四) 分離せる細菌は從來記載せられたる植物の病原細菌より異なり、一の新種なるものと認めたるを以て之れに Bacterium Petasitis n. sp. の學名を附與せり。

(五) 本研究は中田教授指導の下に九大、農學部植物病理學教室にて行ひたるものにして研究及發表に關し日野巖氏の助力を得たるところ多し、共に感謝するところなり。

(大正十三年八月. 九州帝國大學農學部植物病理學教室ニテ)

抄　　録

菌類の半寄生性及寄生の範圍

Young, P.A. :—Facultative parasitism and host ranges of fungi. (American Journal of Botany, Vol. 13, No. 8, pp. 502—520. Oct. 1926.)

小麥、大麥、燕麥、黍等の禾穀類をはじめとして、甘藍、大根等の野菜類、或は豆類、瓜類、蕃茄、苹果等各種の農作物及び其他種々の木本草本に、二十數種の Alternaria, 十數種の Macrosporium, 數種の Helminthosporium, 及び Acrothecium, Diplodia Zeae, Cephalosporium acremonium, Colletotrichum nigrum, Phytophthora cactorum, Botrytis cinerea, Sclerotinia sclerotiorum, Epicoccum Tritici 共他十數種の菌を接種し、共の病原性を驗したり。接種の方法としては多くのものは、無菌的に生育せしめたる苗を、試驗管中に於て接種處置を施し、玉葱、苹果等は、硝子器中に於て切創に接種し、又温室内に於て、硝子鐘を用ゐて多くのものに接種し、大形のものは、硝子函中に於て接種を行ひたり。接種試驗の組合の數は、正に四〇〇に達せんとし、共のうち一九八は、未だ記載せられたる事のなき病害、即ち著者の所謂新病害を發生し、特に Alternaria 及び Macrosporium は、種々の供試植物に病害をおこさしめ、Helminthosporium も是等に劣らざる接種率を示したり。小麥の苗は、試驗管中に於て接種したる場合に、使用したる Alternaria 及び Macrosporium の凡ての種類及び生態的品種に犯さるゝといふ著しき結果を現はしたり。試驗管中或は硝子鐘下に於て行ひたる接種試驗にありては、供試植物は、極めて異常なる條件の下にありて、圃場に於ける天然狀態のものとは、生理的に甚だしく異り、菌の侵害を蒙り易きものと云ふ可し。麥類の銹病等にありては、黃化せる葉に、胞子堆を中心とする綠色の斑點を現はし、菌糸の刺激による葉綠素の生成、或は共の分解の阻止を思はしむる場合少なからざるが Alternaria, Helminthosporium の如き facultaive parasites の侵害に於ても、銹菌の如き寄生性の分化高度なるものと同樣に、綠

色斑點を現す場合を認めたる事は極めて興味ある現象といふ可し。(栃内吉彦)

Trametes subrosea 菌による核果樹の心材赤腐病

Zeller. S. M. :—The Brown Pocket Heart Rot of Stone Fruit Trees Caused by *Trametes subrosea* Weir.

(Journ. Agr. Res. Vol. 33. pp. 687—693, 1926)

著者は木材腐朽菌の生理學的研究者として已に知られたる人にして、本論文に於ては先づ、北米太平洋沿岸諸州の重要生產物となれる洋杏及桃の腐朽病は輕忽に附すべからず、就中從來レッドセダーに寄生菌として知られたる Trametes subrosea Weir による此等果樹の心材腐朽病は最も注意す可きものなることを緒言として、同菌の分布、腐朽の性質、酵素の檢出結果、被害度及防除法に亘りて論じ、同菌は中部カリフオルニアより英領コロンビアに於て洋杏及桃に寄生し殊にウオシントン及オレゴン州に其害甚しく、かゝる菌の性質として果樹に、保護せられざる枝の切口、又は傷面等の多き場合に大なる被害を見る。被害材は所々に立方形の着色を呈する腐朽部即ち Brown-pocket rot を形成し其各囊狀部內には赤褐色の極めて收縮破碎し易き腐朽分解物を存す。

本菌の菌糸中より檢出し得たる酵素はエムルシン、リグニナーゼ、セルラーゼ及ヘミセルラーゼの四種にして後三者の存在は本菌が被害樹木の炭水化物を分解して Brown-pocket rot を生ぜしむる所以にして、又エムルシンの存在は本菌が比較的生長速かなる果樹類にも寄生して、材中の糖原質を消費し、被害を大ならしむる所以を物語るものと云ふ可し。

本菌による被害額は大なれども容易に之を算定し難きも、一果樹園に於て洋杏の被害70%に達したることあり。腐朽は單に心材部に止まらず、邊材をも侵し時に細枝に及ぶことあり。被害樹の未だ健全なる邊材部に於て、其春材或は時に秋材部の導管中に充塞細胞の形成を促し水分の流動を妨げて樹木の耐病性を減じ果實の早落、葉の黃變、早落を來すことあり。果樹剪定に際し傷面の被覆をなしたる場合と然らざる場合とにて被害度に大差あり、栽培者間に一定の

剪定方法制定の必要あり、剪定はなるべく早期に行ひ、大枝の切斷を少からしめ切口の防腐、被覆を力むべきこと、及氏が創製による防腐ペンキ（ボルドウ粉劑と亞麻仁油との混合物）の此菌の防除に有效なりしこと等を述べたり。

（龜井專次）

亞麻銹病菌の發育に影響する要素。

Hart, Helen:—Factors affecting the development of flax rust, *Melampsora Lini*(Pers.)Lév. (Phytopathology XVI, pp. 185—205, 1926)

著者は亞麻の銹病を惹起する Melampsora Lini (Pers.) Lév. に就きて特に共の胞子發芽に影響する要素、胞子の生活力、菌の寄生侵入法、潜伏期間の長さに及ぼす外圍の刺戟、土壤中の營養物質の接種に及ぼす影響、寄主植物と菌との間の組織學的關係及び菌の生理的分化現象に就きての實驗結果を擧げたり。

1. 胞子發芽に影響する要素。

銹胞子は蒸溜水上に浮かしたる時は容易に發芽せるも濕度を飽和狀態に保ちたる場合には發芽せず。蒸溜水中に寄主植物の組織の小片を加ふるも發芽に對しては注意すべき程の刺戟現象を認め得ざりき。銹胞子の發芽に及ばす最低溫度攝氏零度、最高溫度攝氏二六度乃至二七度、最適溫度、約攝氏十八度なり。

夏胞子に於ては發芽に及ぼす溫度を關係は殆んど銹胞子同樣なり。更に夏胞子は暗所に於ても明所に於けると同樣なる發芽率を示せり。

冬胞子は種々なる方法に依りて處理せるも休眠期間を短縮せしめ、又は其の發芽を促進せしむる事能はざりき。

2. 胞子の生活力。

夏胞子は比較濕度二〇パーセント及び八〇パーセントに保てるものよりも、比較濕度四〇パーセント及び六〇パーセントに保てる場合に於て其の生活力はより永く保ち得たり。又低溫に於けるよりも高溫に於て迅速に其の生活力を失ふ。適當なる狀態の下に於ては夏胞子は約三ケ月間共の生活力を持續したり。

3. 寄生侵入法。

夏胞子の發芽管は寄主植物の氣孔より內部に侵入す。發芽管は抵抗性の寄主植物に於ても感受性のものに於けると同樣氣孔より侵入するが此際侵入したる菌絲は附近にある寄主植物の組織の二三の細胞を枯死せしめる爲め其れ以上の發育を爲す能はざるを見たり。

4. 潜伏期間の長さに及ぼす要素。

潜伏期間の長さに及ぼす外圍狀態の影響に就きて特に濕度、光線及び温度の三要素に就きて實驗せり。

夏胞子接種後、其の被接種植物を約三時間又は其れ以上濕氣を保たしむるならば接種可能なり。光線は夏胞子堆形成に對して必要にして著者が四〇〇乃至六〇〇燭光の電氣燈を以て晝夜照せるものに於ては接種後六日半にして夏胞子堆現はれたるも、普通の狀態に於けるものに於ては胞子堆出現までに九日を要せり。更に被接種植物を暗所に置く時は潜伏期間を更に延ばし得る事を知れり。夏胞子堆は温度攝氏七度乃至三〇度に於て形成せらるれども、攝氏十六度乃至二二度を以て適溫とす。

5. 土壤中の營養物質の銹菌接種に及ぼす影響

Winona C.I. 179 を殺菌土壤に植ゑ、其れに數種の燐酸鹽、硝酸鹽、硫酸鹽の溶液を與へ、六週間後に接種を行ひ、接種後十日にして觀察したるに、燐酸鹽類を與へたるものに於ては硝酸鹽類及び硫酸鹽類を與へたるものに比して夏胞子堆著しく多く鮮かに發生したり。殊に硝酸鹽類を與へたるものに於ては胞子堆形成は頗る貧弱なりき。

6. 寄主植物と病源菌との間の組織學的關係。

本菌の菌絲は亞麻莖の皮層を貫通し、時に其の纖維束を侵す。然し木質部には達せず。

7. 本菌の生理的分化現象。

著者の實驗に於ては普通亞麻より得たる菌の夏胞子は頗る鮮かに Linum rigidum 上に接種し得たるも、Linum lewisii には接種成功せざりき。更に

Linum lewisii より得たる夏胞子も又普通亞麻に接種不可能なる事を知れり。アルゼンチン種は著者の取扱へる菌の總ての生態種にも免疫なる事を認めたり。

（平塚直秀）

アルターナリア、デイプローデイア其他の菌に於ける、菌絲貫通現象及び半寄生性

Young, P. A.—Penetration phenomena and facultative parasitism in *Alternaria*, *Diplodia* and other fuugi. (Botanical Gazett Vol. 81, No. 3, pp. 258—279, 1926.)

實驗に用ゐたる Alternaria, Acrothecium 及び Helminthosporium の凡ての種類は、小麥の苗に接種したる場合に、Callosity の形成、細胞膜の增厚、細胞の褐變等をおこした。(Callosity とは、菌絲が貫通侵入した場合に、寄主植物の細胞がこれに刺激されて、細胞膜質物をこの菌絲の周圍に生成し、塊狀を呈するものを云ふのである）貫通菌糸は、附着器（アップレソリア）の下面から角皮中に侵入する。其の周圍に形成される Callosities は、球形、長形、多角形等様々の形をなし、光線を屈折して光る。Diplodia Zeae, Cephalosporium acremonium によつて生ずる Collosities は Alternaria によるものよりも、形が細少で數が頗る多い。貫通菌糸は多く縱の細胞膜に侵入し、中層の著しき增厚を促して、細胞膜を肥厚せしめる。接種の起こつた部分に、屢々着色せる圓形の斑點を現はすことあり、この斑點は、四つの層より成り、その中心に位する Collosity は無色である。Alternaria 及び Helminthosporium を培養せる培養基の搾汁、或は菌糸からとつた汁を、小麥の組織に作用させた場合に、何等の變化をも認めなかつた。小麥其他に機械的傷害を與へた場合に、著しき細胞の着色はおこるが Collosity の形成其他の菌糸貫通の際に見る如き現象は現はれなかつた。本研究に於て、著者は各種の菌を以て多數の植物に對して、試驗管中、或は温室內等に於て數百の接種試驗を行ひ二百有餘の未だ記載せられたる事なき所謂新病害の發生せる事を報告して居る。（栃內吉彥）

本會記事

講習會開催　前號に豫報せしが如く第四回夏期講習會は農林省の委託により壹千圓の補助を受け七月三十一日より十日間東京高等蠶絲學校にて開催、出席者一四四名なりき。

總　會　大正十五年四月八日午后一時より學士會館に於て總會を開き會長の選擧を行ひ次期會長に伊藤誠哉博士を、又評議員に安藤農事試驗場長、間部農產課長、樋浦誠、富樫浩吾氏を推薦し、終りて下記講演ありたり。

一、植物病菌の生理學的研究　松本巍氏
一、煙草立枯病に關する研究　中田覺五郎氏
一、歐米視察談　草野俊助氏

昭和二年四月三日午前十時より學士會館に於て總會を開き出席者四十名、會長の選擧を行ひ中田覺五郎氏を推薦し、終つて講演會に移り下記講演ありたり。

講　演

一、稻熱病菌の越年と第一次發病に關する研究　伊藤誠哉氏
一、冬枯禾本科作物葉上の菌核より生ずる Typhula 菌に就て　今井三子氏
一、大麻の細菌病に就て　附桑科植物の細菌病　石山信一氏
一、黍の葉枯病に就て　西門義一氏
一、ポリポーラスオリエンタリスとポリスティクタス、ザングィネウスに就て　逸見武雄氏
一、二三の亞麻の病害に就て　栃内吉彥氏
一、菌核病菌に於ける突然變異の二例　中田覺五郎氏
一、柑橘瘡痂病の病原菌に就て　中村壽夫氏
一、稻苗腐敗病菌の發育と酸素及水素イオン濃度との關係に就て　安部卓爾氏
一、檜の新病害に就て　北島君三氏
一、岐阜縣產柿新病害に就て　樋浦誠氏

會計報告

大正十四年度

收入之部

一金七百八拾圓九錢也

内譯

一金四百拾九圓五拾九錢也	十四年七月會報印刷〆切迄ノ繰越金
一金百八拾五圓五拾錢也	會費及廣告料
一金百七拾五圓也	講習會講師、堀、草野、中田、石山、末松、逸見、松本、栃内、卜藏諸氏寄附金

支出之部

一金參百八拾九圓八拾六錢也

内譯

一金參百八拾五圓也	會報印刷費
一金四圓八拾六錢也	通信費、文具費
差引殘金　參百九拾圓貳拾參錢也	之ヲ次年度繰越金トナス

大正十五年度

收入之部

一金四百〇參圓七拾參錢也

内譯

一金參百九拾圓貳拾參錢也	前年度繰越金
一金拾參圓五拾錢也	會費本年度收入

支出之部

一金貳拾八圓貳拾錢也

内譯

一金拾七圓五拾錢也	總會費用（席料其他）
一金七圓七拾錢也	通信費（總會通知、會報送料其他）
一金參圓也	文具費（紙代、帳簿其他）
差引金參百七拾五圓五拾參錢也	之ヲ昭和二年度繰越ス

夏期講習會經費決算報告

一金千百參拾九圓〇四錢也

内譯

講習會費

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一金貳百拾貳圓七拾參錢也	消耗品費
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一金貳拾八圓〇五錢也	印刷代、證書、規則書、筆稿料
一金參圓參拾錢也	通信費
一金貳拾五圓也	人夫賃
一金參圓四拾五錢也	雜費

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日本植物病理學會報第二卷第一號目次

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